NewFields

Attachment B

Final Quality Assurance Project Plan for Commonwealth Oil Refining Company, Inc. RCRA Facility Investigation

Prepared by NewFields Atlanta, LLC
for
Commonwealth Oil Refining Company, Inc.
Peñuelas, Puerto Rico

Based on the Intergovernmental Data Quality Task Force
Uniform Federal Policy for Quality Assurance Project Plans
Part 1: UFP-QAPP Manual
(Final Version 1, March 2005)

May, 2014

1.0 PROJECT MANAGEMENT AND OBJECTIVES

1.1 TITLE AND APPROVAL PAGE

Site Name/Project Name: Commonwealth Oil Refining Company, Inc. (CORCO) Resource Conservation Recovery Act (RCRA) Facility Investigation
Site Location: Peñuelas, Puerto Rico
Document Title: Attachment B: Final Quality Assurance Project Plan for CORCO RCRA Facility Investigation
Lead Organization: CORCO
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Preparation Date: 1, August 2013

Roberto Gratacos Project Director CORCO	Date	Warner Golden, P.E. Project Director NewFields Atlanta, LLC	Date
Rolando Mendez Project Manager CORCO	Date	Charlene T. Rivard Quality Assurance Officer/GIS NewFields Atlanta, LLC	Date
Heidy Alfonso QA/QC Operations Manager Beckton Environmental Laboratories, Inc.	Date	Ismael Martinez Technical Advisor Beckton Environmental Laboratories, Inc.	Date
Eduardo Gonzalez Project Manager EPA Region 2 – Caribbean Office	Date	Dale Carpenter Caribbean Region Chief EPA Region 2	Date
Mr. Alecxy Cintrón Project Manager Puerto Rico Environmental Quality Board	Date	Mrs. Frances M. Segarra Román QA/QC Specialist Manager Puerto Rico Environmental Quality Board	Date

Document Control Number:
275:2007/R3:2014/001

1.2 DOCUMENT FORMAT AND TABLE OF CONTENTS

1.2.1 Document Control Format

The Document Control Format for this Quality Assurance Project Plan (QAPP) will abide by the following format:

Title: Attachment B: Final Quality Assurance Project Plan for CORCO RCRA Facility Investigation
Revision number: 3
Revision Date: 02/24/2014
Page: Page 4 of vii

1.2.2 Document Control Numbering System

The Document Control Number System will consist of the following numbers:

275:2007 – Number of Original Document produced in 2007.

R3:2014 – Revision 3 produced in 2014. Subsequent revisions will replace this number with revision number and year produced.

XXX – Individual number assigned to each copy of the QAPP distributed to the recipients listed in Table 1-1.

1.2.3 Table of Contents

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List of Acronyms

AOC	Area of Concern
API OWS	American Petroleum Institute Oil/Water Separator
ASTM	American Society for Testing and Materials
BGS	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
%C	Percent Completeness
CLP	Contract Laboratory Program
CMS	Corrective Measures Study
COC	Contaminants of Concern
CORCO	Commonwealth Oil Refining Company, Inc.
DAF	Dissolved Air Flotation
DD&D	Decommissioning, Deconstruction and Demolition
DPT	Direct Push Technology
DQO	Data Quality Objectives
EDD	Electronic Data Deliverable
EI	Environmental Indicators
EICP	Extracted Ion Current Profile
EISOPQAM	Environmental Investigations Standard Operating Procedures and Quality Assurance Manual
EL	Eastern Lagoon
EPA	U.S. Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbon
FBQSTP	Field Branches Quality System and Technical Procedures
GPS	Global Positioning System
HAZWRAP	Hazardous Waste Remedial Actions Program
ICP	Inductively Coupled Argon Plasma Spectrophotometer
ID	Identification
IDL	Instrument Detection Limit
IDW	Investigation Derived Waste
LCS/LCSDs	Laboratory Control Sample/Laboratory Control Sample Duplicates
LFB	Laboratory Fortified Blank
LPCA	Land Pollution Control Area
LQAP	Laboratory Quality Assurance Plan
MCAWW	Methods for Chemical analysis of Water and Wastes
MDEP	Massachusetts Department of Environmental Protection
MDEP-EPH	Massachusetts Department of Environmental Protection – Extractable Petroleum Hydrocarbons
MDEP-VPH	Massachusetts Department of Environmental Protection – Volatile Petroleum Hydrocarbons
MDL	Method Detection Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NPDES	National Pollution Discharge Elimination System

NTU	Nephelometric Turbidity Units
OXO/CIC	Oxochem/Caribe Isoprene Corporation
PAH	Polyaromatic Hydrocarbons
PCB	Poly-Chlorinated Biphenyls
PE	Performance Evaluation
PPE	Personal Protection Equipment
ppm	parts per million
PQL	Practical Quantitation Limit
PQO	Project Quality Objectives
PREPA	Puerto Rico Electric Power Authority
PREQB	Puerto Rico Environmental Quality Board
PT	Proficiency Testing
QA/QC	Quality Assurance/Quality Control
QAP	Quality Assurance Plan
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QL	Quantitation Limit
RAGS	EPA Risk Assessment Guide for Superfund
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSD	Relative Standard Deviation
RSL	Regional Screening Level
SDG	Sample Delivery Group
SESD	Science and Ecosystem Support Division
SOP	Standard Operating Procedure
SSRRS	Site Specific Risk Reduction Standards
SU	Standard Units
SVOC	Semi-volatile Organic Compound
SW-846	Test Methods for Evaluating Solid Waste Physical/Chemical Methods
UCL	Upper Confidence Level
UST	Underground Storage Tank
VOC	Volatile Organic Compound
VPH	Volatile Petroleum Hydrocarbon
VSP	Visual Sample Plan
WWTP	Waste Water Treatment Plant
XRF	X-Ray Fluorescence

1.2.4 QAPP Identifying Information

- **Site name/project name** – CORCO RCRA Facility Investigation
- **Site location** – Peñuelas, Puerto Rico
- **Site number/code** – N/A
- **Operable unit** – N/A
- **Contractor name** – N/A
- **Contractor number** – N/A
- **Contract title** – N/A
- **Work assignment number** – N/A
- **Guidance used to prepare QAPP** - Intergovernmental Data Quality Task Force *Uniform Federal Policy for Quality Assurance Project Plans Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs Part 1: UFP-QAPP Manual*, (EPA-505-B-04-900A), DTIC ADA 427785). Final Version 1 March 2005.
- **Regulatory program** - RCRA
- **Approval entity** – United States Environmental Protection Agency (EPA) Region 2
- **Data users** – EPA Region 2, CORCO, NewFields Atlanta, LLC
- **Identification as a generic or project-specific QAPP** – Project Specific
- **Scoping session dates** – January 12, 2007; February 15, 2007; February 22, 2007; June 14, 2007; June 27-28, 2007; January 20, 2010; March 19, 2010; October 11, 2011; December 14-15, 2011; and, March 12, 2013.

1.3 DISTRIBUTION LIST AND PROJECT PERSONNEL SIGN-OFF SHEET

1.3.1 Distribution List

Table 1-1 contains a list of the entities to which copies of the approved QAPP and any subsequent revisions will be issued.

Table 1-1
QAPP Distribution List

QAPP Recipient	Title	Organization	Telephone	Fax	E-mail Address	Document Control Number
Eduardo Gonzalez	EPA Project Manager	EPA Region 2 Caribbean Office	787-977-5839	787-729-7748	gonzalez.eduardo@epa.gov	275:2007/R3:2014/001
Dale Carpenter	Caribbean Region Chief	EPA Region 2	212-637-4166	212-637-4437	carpenter.dale@epamail.epa.gov	275:2007/R3:2014/002
Roberto Gratacos	Project Director	CORCO	787-843-3030	787-836-1269	corcoadm@caribe.net	275:2007/R3:2014/003

QAPP Recipient	Title	Organization	Telephone	Fax	E-mail Address	Document Control Number
Rolando Mendez	Project Manager	CORCO	787-843-3030	787-836-1269	corcoenv@caribe.net	275:2007/R3:2014/004
Warner Golden	Project Manager	NewFields Atlanta, LLC	205-981-6477	205-995-6922	wgolden@newfields.com	275:2007/R3:2014/005
Charlene Rivard	Quality Assurance Officer	NewFields Atlanta, LLC	404-347-9050	404-347-9080	crivard@newfields.com	275:2007/R3:2014/006
F. Edwin Hallman	Attorney	Hallman and Wingate	404-588-2530	404-588-2535	ehallman@hallmanwingate.com	275:2007/R3:2014/007
Mr. Alecxy Cintrón	Project Manager	Puerto Rico EQB	787-767-8181	787-767-4861		275:2007/R3:2014/008
Mrs. Frances M. Segarra Román	QA/QC Specialist Manager	Puerto Rico EQB	787-767-8181	787-767-4861		275:2007/R3:2014/009
Heidy Alfonso	QA/QC Operations Manager	Beckton Environ. Laboratories	787-841-7373	787-841-7313	halfonso@beckton.com	275:2007/R3:2014/010

1.3.2 Project Personnel Sign-Off Sheet

The Project Personnel Sign-Off Sheet in Table 1-2 documents that all key project personnel performing work have read the applicable sections of the QAPP and will perform the tasks as described. Signatures of project personnel not involved with the planning, writing, and approval of the QAPP will be added to Worksheet #4[1] in Appendix A.

Table 1-2
Project Personnel Sign-Off Sheet

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Eduardo Gonzalez	EPA Project Manager	787-977-5839		
Dale Carpenter	Caribbean Region Chief	212-637-4166		
Roberto Gratacos	Project Director	787-843-3030		
Rolando Mendez	Project Manager	787-843-3030		
Warner Golden	Project Manager	205-981-6477		
Charlene Rivard	Quality Assurance Officer	404-347-9050		
F. Edwin Hallman	Attorney	404-588-2530		
Mr. Alecxy Cintrón	PREQB Project Manager	787-767-8181		
Mrs. Frances M. Segarra Román	PREQB Specialist Manager	787-767-8181		

[1] According to the UFP-QAPP Manual dated March 2005, "Applicable appendices and/or attachments include but are not limited to the following:…The completed QAPP worksheets, if the QAPP worksheets are used and not included as tables in the QAPP".

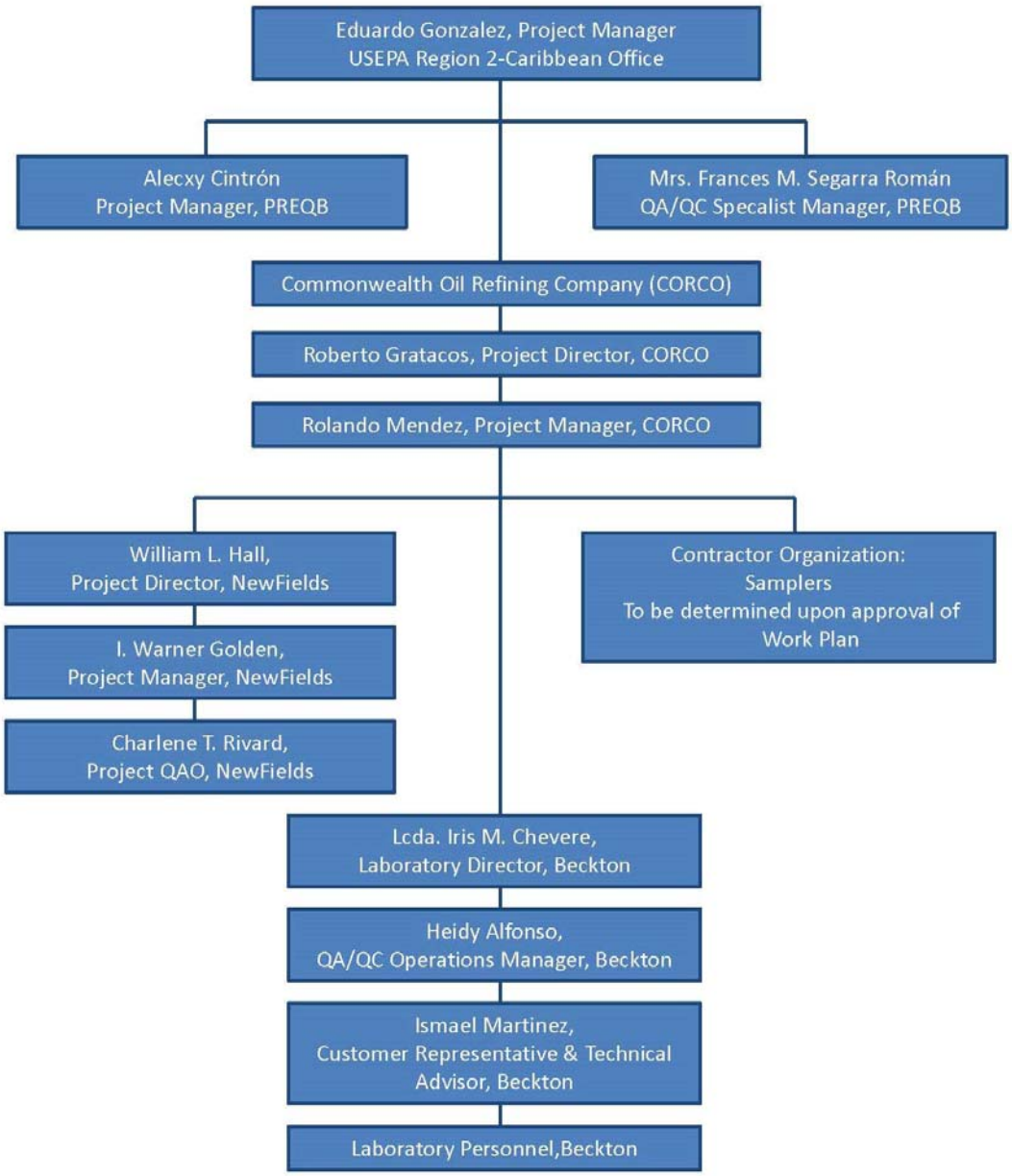
Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Heidi Alfonso	Beckton QA/QC Operations Manager	787-841-7373		

1.4 PROJECT ORGANIZATION

1.4.1 Project Organizational Chart

The Project Organizational Chart in Figure 1-1 and QAPP Worksheet #5 included in Appendix A shows the reporting relationship between all organizations involved in the project, including CORCO, NewFields Atlanta, LLC (NewFields), Beckton Environmental Laboratories, Inc. Beckton), and the sampling contractor which will be chosen upon approval of the RCRA Facility Investigation (RFI) Work Plan. The QAPP will be revised for final approval upon selection of the sampling contractor.

FIGURE 1-1
PROJECT ORGANIZATIONAL CHART



1.4.2 Communication Pathways

The Project Communication Pathways are included in Worksheet #6 in Appendix A.

1.4.3 Personnel Responsibilities and Qualifications

The EPA Region 2 *Project Manager* (Eduardo Gonzalez-Region 2 Caribbean Office) has the authority lawfully vested in a Remedial Project Manager (RPM) or On-Scene Coordinator under 40 Code of Federal Regulations (CFR) 300. The RPM is responsible for directing and/or overseeing and coordinating all project activities. Therefore, the RPM coordinates, directs and reviews the work of other agencies, CORCO, and contractors to assure compliance with the decision documents; he is the prime contact for remedial or other response actions; and, recommends action for decisions and participates in all decision-making processes necessary to ensure compliance with the decision documents. He is also responsible for submitting the QAPP, QAPP revisions, and QAPP amendments to the appropriate personnel for their review and approval.

The Puerto Rico Environmental Quality Board (PREQB) *Project Manager* (Alecxy Cintrón-Hazardous Waste Permit Division) performs the review of technical documents (i.e. Corrective Action Work Plans, RFI Work Plans, etc.) and field oversight activities as part of the Systematic Planning Process implemented and established by the PREQB Land Pollution Control Areas (LPCA) Quality Management Plan. The PREQB project manager may also provide comments and recommendations to the EPA RPM.

The PREQB QA/QC Specialist Manager (Frances M. Segarra Román-LPCA) provides support to the Hazardous Waste Permit Division in the quality and technical review of Correction Action Plans, RFI Sampling Analysis Plans, QA/QC data reports submitted for Corrective Action investigations, QAPPs for investigative or remedial projects, etc. The QA/QC Specialist Manager also performs technical and quality document review and field oversight/auditing activities as part of the Systematic Planning Process implemented and established by the PREQB LPCA Quality Management Plan.

CORCO is responsible for implementing the RFI work plan. They are also responsible for ensuring that the QAPP is accurate and complete, that it conforms to the requirements stated in the UFP-QAPP manual, and that all project quality objectives (PQOs), technical activities, and related QA/QC result in data of known and documented value. The CORCO **project director** is Roberto Gratacos. He is responsible for overall project management and direction. The CORCO **project manager** is Rolando Mendez, who is responsible for management of technical activities and he provides project oversight; reviews project status reports and requests for changes in project personnel; authorizes change orders; and reviews and approves budgets and schedules. CORCO will approve all reports (deliverables) before their submission to EPA Region 2.

The NewFields **project director** is William L. Hall who will have primary responsibility for all Contractor project activities. The **project manager,** I. Warner Golden will coordinate all personnel and project activities. He will provide technical assistance as needed and will have the ultimate responsibility for project performance and data quality. Mr. Golden will coordinate onsite activities and will also act as liaison between CORCO and field personnel/activities.

Responsibilities for QA/QC lie with the project's **quality assurance officer (QAO)**, Charlene T. Rivard, who will recommend and implement corrective measures, evaluate all project data, and perform audits to determine proper performance and compliance with the QAPP. The QAO will be responsible for adherence to all QA/QC as defined in the QAPP and for maintaining the approved QA Project Plan at the project site. She is also responsible for checking that correct procedures are used and has the authority to initiate a work stoppage to correct any quality concerns that should arise during the RFI. Mrs. Rivard is also NewFields Atlanta, LLC Health and Safety Officer. She will also be responsible for assuring that all field personnel adhere to the site Health and Safety Plan, including all decontamination procedures. A safety log of site activities will be maintained in which any safety violations, variances, and corrective actions will be noted. Contractors will be held responsible for the implementation of their own Site Safety and Health Plan.

Field personnel will directly perform all field activities in accordance with this document, including: (1) accurately and precisely completing all sampling documentation (including the field logbook); (2) handling samples, including packaging for shipment to the laboratory; (3) closely coordinating with the project director and project manager.

Beckton Environmental Laboratories, Inc. (Beckton) has been chosen by CORCO to perform all of the analytical work during the RFI. They will be certified to perform work in Region 2 and will adhere to the requirements outlined in this QAPP and the laboratory's quality assurance plan (QAP). The laboratory's QAP will be on file in the CORCO library, at NewFields Atlanta office, and with Region 2. Region 2 does not have a laboratory certification program; however, Beckton's most recent Laboratory Quality Assurance Plan (LQAP) (Appendix B) shall be submitted for review including any Standard Operating Procedures (SOP's) (Appendix C). The laboratory will also submit current copies (within the past six months) of their laboratory certification obtained from either a state or Federal agency, which conducts certification. This certification will be applicable to the matrix/analyses for all Non-Contract Laboratory Program (CLP) analysis performed for this project. In addition, Beckton will submit results of the Performance Evaluation (PE) samples analyzed within the past six months for all Non-CLP tests. If these results are not available, they will complete PE's for the proposed matrixes/analyses and submit the results to the EPA Region 2. The certifications and PE results can be found in Appendix B. CORCO will retain the analytical laboratory through a service agreement, which will specify the expected scope of services, the analytical QA requirements, and the information to be developed and reported.

1.4.4 Special Training Requirements and Certification

Any special training requirements and certifications required for the implementation of the RFI can be found in Worksheet #8 in Appendix A.

1.5 PROJECT PLANNING/PROBLEM DEFINITION

1.5.1 Project Planning (Scoping)

This RFI Work Plan has been prepared by CORCO in response to a letter request from EPA dated October 2, 2006. The Work Plan addresses all facilities owned by CORCO. The objective of this RFI Work Plan is to provide a roadmap and implementation schedule for the investigation of the following Areas of Concern (AOCs) at the CORCO facility.

- Area 1 - CORCO Main Site - main tank farm and ancillary/support activities and services, and former refinery units located north and south of Highway 127;
- Area 2 - Western Lagoons - former wastewater treatment facility and Jakes Lagoon;
- Area 3 - Flores Peninsula at Guayanilla Bay;
- Area 4 - Oxochem and Caribe Isoprene Corporation;
- Area 5 - Eastern Lagoon;
- Area 6 – Area North of CPI No. 2;
- Area 7 – Tallaboa Pipeline;
- Area 8 – Main Site Active Pipeline; and,
- Area 9 – Caribe Isoprene Corp. Tanks.

As stated in the EPA letter, the purpose of the RFI is to obtain information to fully characterize the nature, extent and rate of migration of releases, the presence any of hazardous waste or constituents, and to interpret this information to determine, based on risk assessment, whether interim corrective measures and/or a Corrective Measures Study are necessary. This RFI Work Plan will address the CORCO Site on an area by area basis (Areas 1 through 9) using existing data to the maximum extent possible. The Site location is shown on Figure 1-2 and the Site AOCs are shown on Figure 1-3.

1.5.2 Problem Definition, Site History, and Background

1.5.2.1 Problem Definition

The nine areas that make up the CORCO facility are not well delineated. The RFI Work Plan and this QAPP will encompass the collection of soil and groundwater samples to fully

characterize the nature, extent and rate of migration of releases, if any of hazardous waste or constituents of all AOCs at the CORCO facility.

This QAPP presents project-specific Quality Assurance and Quality Control (QA/QC) requirements, organization, laboratory analysis procedures, field analysis, data interpretation, and management goals established for the techniques required for the RFI Work Plan. It also delineates procedures for obtaining sufficient data quantity and quality to meet established project objectives at the CORCO Site in Peñuelas, Puerto Rico.

1.5.2.2 Site History

CORCO operated an integrated petroleum refinery at the Peñuelas, Puerto Rico location from 1952 to approximately 1982 when refining and petrochemical operations ceased. Operational history for the period prior to present ownership was obtained through interviews with plant personnel who were employed or are knowledgeable of refinery operations during that time.

In 1976, the company entered bankruptcy due to deteriorating economic conditions. CORCO assets were acquired out of bankruptcy in the early 1980s. The Site as it appeared in the 1970's and 1980's is shown on Figure 1-4. The acquired assets (shown on Figure 1-3), included the Main Site and its pipeline, the Western Lagoons, Flores Peninsula, the Oxochem and Caribe Isoprene facilities, the Eastern Lagoon, the Area North of CPI No. 2, the Tallaboa Pipeline, the Main Site Pipeline, and the Caribe Isoprene Corp. Tanks, are the properties addressed by this Plan. At the time of the acquisition, the current owners converted the facilities operations exclusively to a terminal and storage business, using the deepwater dock and storage tanks located at the Facility. The current owners never operated the refinery facilities. CORCO continues to operate as a petroleum terminal and storage business.

1.5.2.3 Background

Prior to acquisition by the current owners, CORCO filed a RCRA Part A permit application for the Facility in November of 1980. However, petrochemical operations ceased in November of 1981 and all refinery operations at the Facility were suspended in March of 1982. Since the

current owners converted the Facility to a petroleum products terminal operation, the RCRA permit application process was terminated because the Facility would no longer manage, store or treat RCRA hazardous waste.

At the time of the 1980 RCRA permit application, the Facility's wastewater treatment system consisted of an American Petroleum Institute Oil/Water Separator (API OWS), a dissolved air flotation (DAF) unit, two storage tanks for petroleum products recovered from the wastewater treatment process, an aeration lagoon and an oxidation lagoon. Two cooling ponds were adjacent to the aeration lagoon but received no wastewater streams and were not connected to the aeration lagoon. These ponds only received once-through non-contact cooling water from the refinery cooling system. The cooling water lagoons and the aeration lagoon discharged into the oxidation lagoon. Collectively, the aeration lagoon, oxidation lagoon, and cooling lagoons are referenced herein as the Western Lagoons.

The API OWS was upgraded in 1977. The DAF unit was installed at that time for the purpose of improving oil recovery and to aid oil recycling to a process visbreaker unit. The float from the DAF was mixed with the API OWS skimmings. Oil float and skimmed oil from the API OWS were then discharged into two tanks, 1008 and 1030. It is believed Tank 1030 was taken out of service prior to November 1980, effective date of RCRA. Tank 1008 was used for this purpose after RCRA became effective. During refinery operations, this slop oil was reprocessed through the refinery visbreaker unit and sold as a product. Effluent from the API OWS and DAF unit were treated biologically in the aeration and oxidation lagoons.

A disposal site was constructed on a leased property east of the Tallaboa River sometime after January of 1977. This lagoon is referenced as the Eastern Lagoon (EL). At the same time, wastewater treatment efficiency was upgraded through enhancement of the aerators in the Aeration Lagoon in the western lagoon area. Sediments/soils from the Western Lagoons were reportedly transported to the EL.

The 1980 RCRA Part A Permit Application described the EL as a possible future disposal site for API OWS sludge. However, the document also stated that the sludge previously was recycled into road asphalt for the tank farm. According to the permit application, these reuse practices were terminated by November of 1980. There is no documentation regarding the disposition of API OWS sludge after the time of the Part A Permit Application. There is no documentation that the EL was used for disposal after the effective date of the hazardous waste listing for (K049) API OWS sludge. CORCO and its counsel have inquired of all available personnel whether API OWS sludge was placed in the EL after November 1980. All personnel reported that no such disposals were conducted.

After refinery operations were suspended in 1982, recovered oil from the DAF unit and the API OWS remained in Tanks 1008 and 1030. Once the refinery operations permanently ceased, the recovered material could no longer be recycled to the refinery. As a result, some of the recoverable oil was sold in 1984. Sludge and oil remaining in the tanks at this time may be partially recoverable as a usable product.

The API OWS remained operational after 1982 for the purpose of recovering oil from storm water resulting from the terminal operation. The National Pollution Discharge Elimination System (NPDES) permit for the Facility (dating back to 1986) has remained in force to regulate possible storm water discharges from the terminal activities. The NPDES permit for storm water discharge has been renewed since 1996 with the current NPDES permit expiring in April 2007. A renewal application was filed in November 2006 and has been designated complete by EPA Region 2 and forwarded to PREQB for issuance of the corresponding Water Quality Certificate.

1.5.2.3.1 1990 Consent Order

In 1990, EPA and CORCO entered into a settlement agreement and consent order with the EPA to, among other issues, close the seven units (East Cooling Water Lagoon, West Cooling Water Lagoon, Oxidation Lagoon, Aeration Lagoon, Eastern Lagoon, and Slop Oil Tanks 1008 and 1030) in accordance with RCRA requirements and reserved all of CORCO's defenses. An additional requirement is the preparation of an RFI to address free hydrocarbon in groundwater.

From 1990 through 1998, CORCO and the EPA engaged in negotiations and proceeded to address several issues toward preparation of the RFI. In 1999, CORCO completed a comprehensive environmental audit, which was submitted to the EPA in April of 1999. The audit proposed closure plans and provided concepts for managing the environmental issues at the Facility. With this submission of the RFI Work Plan, CORCO is in compliance with the requirements of the 1990 Consent Order.

1.5.2.3.2 2000 RCRA Unit Work Plan

In 1999 CORCO prepared and submitted plans to the EPA for closure of the seven units in accordance with RCRA. The plans included revisions of water/wastewater treatment alternatives including possible reactivation of the units and construction of a new separate wastewater facility. CORCO and NewFields met with the EPA regarding the RCRA Unit Closure Plan in July of 1999.

In March 2000, the EPA requested that CORCO submit either a notification of intent to implement the previous closure plans or submit an alternative plan by May of 2000. In May 2000, CORCO submitted a revised RCRA Units Closure Plan to EPA and in December 2001, CORCO submitted an addendum to this plan. EPA partially commented upon the RCRA Units Closure Plan in March of 2004 addressing two of the seven units, Tanks 1008 and 1030, and requested CORCO to proceed with their closure. CORCO prepared and submitted in January of 2005 a closure plan for these tanks. In September of 2006, EPA approved the Tank 1008 and 1030 Closure Plan.

In August of 2006, EPA requested that CORCO perform characterization sampling of the Eastern and Western Lagoons for the determination of hazardous waste characteristics. A Characterization Sampling Work Plan for the Eastern and Western Lagoons was submitted in September 2006 and approved by EPA later that same month. The results of this sampling confirmed that these lagoons did not contain characteristic hazardous waste.

In October of 2006, EPA sent a letter to CORCO requesting the preparation of an RFI Work Plan for the Facility.

1.5.2.3.3 Other Actions

While EPA and CORCO addressed closure plans and investigations, several interim steps occurred which addressed environmental issues at the Facility as follow:

- July of 2000, CORCO characterized and disposed of drummed and bagged materials on the Site and removed acid materials from Tanks 751, 753, 1101 and 1103;
- November of 2000, Puerto Rico Electric Power Authority (PREPA) prepared a Phase II Environmental Site Assessment of the property in conjunction with a possible purchase of CORCO;
- December of 2001, CORCO prepared an Acid Tanks 751, 753, 1101 and 1103 Closure Report;
- January of 2003, CORCO prepared a report for soil sampling at former Underground Storage Tank (UST) areas;
- EPA requested RCRA 3007 Information for the Facility in February of 2004; this document was submitted in April of 2004. Also at that time, CORCO submitted an updated Historical Free Product Evaluation Report to EPA;
- October of 2004, EPA requested that CORCO prepare an Environmental Indicators (EI) Report;
- February of 2005, CORCO submitted a report entitled Existing Data and Identified Data Gaps; EPA met with CORCO regarding the EI in March of 2005;
- CORCO submitted the EI Report in September of 2005 and EPA issued a Documentation of EI Determinations in November of 2005;
- November of 2005, CORCO prepared a Health and Safety Plan for Soil Disturbance Activities; and,
- August of 2006, EPA sent CORCO a letter requesting testing for characteristics of hazardous wastes at the Eastern and Western Lagoons.

1.5.2.3.4 Acid Tank Cleanout and Drum Disposal

During the summer of 2000, CORCO voluntarily removed acid materials used in former refinery operations from tanks 751and 753, which were located at the CORCO Main Site, and Tanks 1101 and 1103, which were located at the Oxochem facility. The details of this cleaning operation are provided in the report entitled "Closure Certification Report Acid Tanks 751, 753, 1101 and 1103 for CORCO", dated December 2001. The tank materials were characterized and neutralized by adding a mixture of lime, cement kiln dust and water, and ultimately disposed in

accordance with regulatory requirements. Any visibly impacted soils from around the tanks was removed and neutralized along with the acid material. Tanks 751 and 753 and their associated piping were demolished and the steel was sold for recycling. Tanks 1101 and 1103 were cleaned and remain empty in place. These tanks were cleaned, in accordance with good engineering practices and applicable regulations.

CORCO also addressed more than 2,000 drums and bags of solid and liquid product, intermediate materials and raw materials used during refinery operations. The various drums and their contents were characterized, consolidated according to compatibility, and disposed in accordance with regulatory and disposal facility requirements. The empty drums were shipped off-site for disposal at a local landfill.

1.5.2.3.5 PREPRA CSA Phase II Environmental Assessment Report

As part of a possible purchase of the CORCO facilities, PREPA engaged CSA Group to perform a Phase II investigation at CORCO (CORCO Phase II Environmental Assessment, CSA Group, November 2000). The areas which were evaluated in the CSA Phase II report include the Main Site, Western Lagoons, Flores Peninsula, Oxochem / Caribe Isoprene, and the Eastern Lagoon. The data collected during the Phase II have been incorporated into the site database to be utilized in preparation of the RFI.

1.5.2.3.6 3007 Information Request

EPA requested in February of 2004 that CORCO provide a 3007 response concerning environmental issues at the site. CORCO responded in April 2004 by sending copies of the following available information to EPA:

- CORCO Health and Safety Plan;
- Historical Free Product Report;
- Tank 1007 Repair Status Report;
- Acid Tank Closure Report; and,
- Phase II Environmental Assessment.

1.5.2.3.7 Environmental Indicators

In a letter from EPA in October 2004, the EPA asked CORCO to file a report to address EIs. CORCO submitted an initial report in February of 2005. After a meeting with EPA in March of 2005, CORCO conducted additional studies with the intent of filling the data gaps in the data necessary for such assessment. The final report from CORCO was completed in September 2005. The report indicated that the risk "exposures are within acceptable limits". The final determination report by EPA in November 2006 found "Current Human Exposure Under Control (CA 725)" and "Migration of Contaminated Groundwater Under Control (CA750)".

1.5.2.3.8 RCRA Units - Slop Oil Tanks 1008 and 1030 Closure

Two of the units proposed for closure in the May 2000 RCRA Unit Closure Work Plan were Tanks 1008 and 1030, also known as the slop oil tanks. These tanks were part of the wastewater treatment system during refinery operations. In a March 2004 letter, EPA provided partial approval of the closure of Tanks 1008 and 1030 and requested that CORCO prepare final closure plans for these two RCRA units. CORCO submitted the RCRA Unit Tank 1008 and 1030 Closure Plan in June of 2006. EPA approved the closure plan in September of 2006 and the units were finally closed in 2011.

1.5.2.3.9 Western and Eastern Lagoons Characterization Sampling

Pursuant to our May 2000 RCRA Unit Closure Work Plan, in August of 2006 EPA requested that CORCO perform hazardous waste characterization sampling of the materials present in the remaining units which were originally addressed in that plan. These units included the Eastern Lagoon, East Cooling Water Lagoon, West Cooling Water Lagoon, Aeration Lagoon and Oxidation Lagoon. CORCO submitted a Characterization Sampling Work Plan in August of 2006. The work plan was approved by email from EPA in early September of 2006 and sampling was completed in September. The conclusions based on the results of the sampling were that these lagoons did not contain characteristic hazardous waste.

1.5.2.3.10 Reports and Data Evaluated

The following reports and data were reviewed and analyzed as part of the development of the RFI Work Plan. These reports have been forwarded to EPA Region 2 with the EI submittal in late 2005.

A. Preliminary Assessment/Site Investigation Final Report, Addendum to Site Assessment Report Prepared by GDC Engineering Inc., dated August 31, 1994;
B. Site Assessment Report, Commonwealth Oil Refining Company Inc., Ponce, Puerto Rico, August 31, 1994;
C. Commonwealth Oil Refining Company, Phase I: Subsurface Oil Investigation Report, EPA I.D. PRD091017228, DSM Project No. 1012-01-01, November, 1994;
D. Monitor Well Installation, Monitor Well Plug & Abandonment, Eastern Oil Lagoon Impoundment Sampling & Monitor Well Level Measurement Addendum Project, February 8, 1995;
E. Eastern Oil Lagoon Area Groundwater Risk Analysis, DSM Project No. 1029, April 1995;
F. DSM Phase II: Subsurface Product Delineation Report, DSM Project No. 1035-01, February 1996;
G. DSM Phase II: Subsurface Product Delineation & Formation Evaluation Work Plan, EPA I.D. PRD09017228, Letter Report on the Findings of the Off-Property subsurface Product Delineation Program dated February 23, 1998;
H. DSM Phase II: Subsurface Product Recovery Simulation Report, DSM Project No. 116-01, April 1998;
I. DSM Phase II: Subsurface Product Recovery System Design, DSM Project No. 1125-01, dated August 14, 1998;
J. Environmental Status Report, Shell Fuel Terminal, Guayanilla, Puerto Rico, DSM Project No. 1130-01, dated October 6, 1998;
K. CORCO Phase II Environmental Site Assessment, CSA Group, November 2000;
L. Soil Sampling of Former UST Areas, CORCO Facility, Peñuelas, PR, GeoEnviroTech, Inc., dated January 13, 2003;
M. Historical Free Production Evaluation, CORCO, NewFields, April 2004;
N. Monitoring Wells Installation and Groundwater Sampling at Oxochem/Caribe Isoprene, Peñuelas, PR, On-Site Environmental, July 2005;
O. Potential Receptor Evaluation – Mangrove Land Crabs in the Effluent Channel Area at CORCO, Peñuelas, PR, On-Site Environmental, August 2005;
P. Tier 2 and 3 Subsurface Vapor Intrusion Screening at CORCO, On-Site Environmental, August 2005;
Q. Results of a Site Assessment Program for Environmental Indicators, Main Site, CORCO, Peñuelas, PR, AGES, September 2005;

R. Results of a Site Assessment Program for Environmental Indicators, Jakes Lagoon, CORCO, Peñuelas, PR, AGES, September 2005;
S. Results of a Site Assessment Program for Environmental Indicators, Flores Park, CORCO, Peñuelas, PR, AGES, September 2005;
T. Health and Safety Plan, Peñuelas, PR, NewFields, September 2005;
U. Screening Level Human Health Risk Evaluation of Land Crab Consumption Exposure Pathway, CORCO, Peñuelas, PR, NewFields, September 2005;
V. Documentation of Environmental Indicators Determination, EPA I.D. No. PRD091017228, EPA Region 2, November 2005;
W. January 2004 Through December 2005 Free Product Monitoring Report, CORCO, Peñuelas, PR, NewFields, May 2006;
X. Results of a Sediment Sampling Program, Eastern and Western Oil Lagoons, CORCO, Peñuelas, PR, AGES, October 2006;
Y. January 2006 Through December 2006 Free Product Monitoring Report, CORCO, Peñuelas, PR, NewFields, May 2007; and,
Z. Decommissioning, Deconstruction, and Demolition of Abandoned Refinery Units, Draft Report, CORCO, Peñuelas, PR, NewFields, September 2003.

The data contained in these reports were entered into the project Geographical Information System (GIS) database.

1.6 PROJECT QUALITY OBJECTIVES AND MEASUREMENT PERFORMANCE CRITERIA

1.6.1 Development of Project Quality Objectives Using the Systematic Planning Process

The Project Quality Objectives presented were based on the seven-step process described in the EPA document *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA QA/G-4) February 2006, EPA/240/B-06/001.

Step 1: State the Problem *– a description of the problem(s) and specifications of available resources and relevant deadlines for the study.*

- ***Describe the problem*** *- The nature and extent and rate of migration of releases, if any of hazardous waste or constituents, of the following AOCs at the CORCO facility must be fully characterized.*

- ***Area 1*** *- CORCO Main Site - main tank farm and ancillary/support activities and services, and former refinery units located north and south of Highway 127;*
- ***Area 2*** *- Western Lagoons - former wastewater treatment facility and Jakes Lagoon;*
- ***Area 3*** *- Flores Peninsula at Guayanilla Bay;*
- ***Area 4*** *- Oxochem and Caribe Isoprene Corporation;*
- ***Area 5*** *- Eastern Lagoon;*
- ***Area 6*** *– Area North of CPI No. 2;*
- ***Area 7*** *– Tallaboa Pipeline;*
- ***Area 8*** *– Main Site Active Pipeline; and,*
- ***Area 9*** *– Caribe Isoprene Corporation Tanks.*

- ***Establishing the planning team*** *- The members of the planning team will include Rolando Mendez and Warner Golden. A complete organizational chart can be found on QAPP Worksheet #5 in Appendix A of this document. The primary decision makers as to where and what samples should be collected, if any additional samples are required, and how samples are to be collected are Rolando Mendez and Warner Golden. Decisions must be acceptable to the EPA Project Manager, Eduardo Gonzalez, and can be reviewed by the PREQB Project Manager, Mr. Alecxy Cintrón.*
- ***Describe the conceptual model of the potential hazard*** *– The most likely source of releases on the Site are from operation of the refinery and tank farm including waste management activities from the 1950s to shut down of the refinery in 1982. Facilities operations were converted to a terminal and storage business in the mid 1980's.*
- ***Specify available resources, constraints, and deadlines for the study*** *– CORCO and NewFields will provide the resources needed to meet the stated objectives. CORCO and NewFields are providing personnel and subcontractors for completion of the project. The project schedule is described in Section 1.8.2 of this document.*

Step 2: Identify the Goals of the Study *– a statement of the decision that will use environmental data and the actions that could result from this decision.*

- ***Identify the principal study question*** *- Are there concentrations in the nine AOCs that would pose an unacceptable human health or ecological risk? These AOCs include the CORCO Main Site, Western Lagoons, Flores Peninsula at Guayanilla Bay, Oxochem and Caribe Isoprene Corporation, Eastern Lagoon, Area North of CPI No. 2, Tallaboa Pipeline, Main Site Active Pipeline, and the Caribe Isoprene*

Corp. Tanks as shown on Figure 1-3. Would the concentrations in these nine AOCs require interim corrective measures and/or a Corrective Measures Study (CMS) to be performed at each individual AOC?

- ***Define alternative actions that could result from resolution of the primary question*** *– Possible alternative actions are as follows:*
    - *Recommend no further action;*
    - *Perform human health and ecological risk assessments and then take no further action; or,*
    - *Perform human health and ecological risk assessments and perform corrective measures.*
- ***Specify the decision statement*** *– Determine whether or not the concentrations in each of the nine AOCs at the CORCO Site pose a risk to either human health or ecological receptors, and if so recommend corrective measures or a CMS in each individual AOC.*

Step 3: Identify Information Inputs *– a list of environmental variables or characteristics that will be measured and other information needed to resolve the decision statement.*

- ***Identify the type of information that is needed to resolve the decision statement*** *- To resolve the decision statement, the planning team needs to obtain measurements of the concentrations of the parameters listed in Table 2-1 of this QAPP in each individual AOC.*
- ***Identify the source of information*** *– Review data from past investigations along with the collection of additional data described in the RFI Work Plan. The additional soil samples will be collected in accordance with the RFI Work Plan and will be tested using the methods listed in Table 2-1 of this QAPP. A full list of past investigations can be found in Section 1.5.2.3. The use of the facility as a petroleum refinery and terminal storage operation, past analytical sampling results, and the results of the past investigations have helped CORCO arrive at the list of parameters in Table 2-1.*
- ***Identify how the action level will be determined*** *– The action levels will be based on the following standards:*
    - *Soil/Sediment*
        - *Field, L., D. MacDonald, S. Norton, C,. Ingersoll, C. Severn, D. Smorong, and R. Lindskoog, 2002. Predicting Amphipod Toxicity from Sediment Chemistry using Logistic Regression Models. Environmental Toxicology and Chemistry, Vol. 21, No. 9, pp. 1993–2005.*

- *McDonald, R. Carr, F. Calder, E. Long, and C. Ingersoll, 1996. Development and Evaluation of Sediment Quality Guidelines in Florida Coastal Waters. Ecotoxicology 5: 253-278.0.*
- *NYSDEC, 1999. Technical Guidance for Screening Contaminated Sediments. New York State Department of Environmental Conservation. Human health bioaccumulation values.*
- *USEPA, 2013. EPA Regional Human Health Screening Levels (RSLs). May 2013. Lowest of the Residential and Industrial Soil RSLs. Where standard not available in 2013 edition, November 2012 edition will be used; and if a standard is not available in Nov. 2012 edition, June 2011 edition will be used.*
- *USEPA Region 2, 2010. New York Freshwater and Marine Screening Benchmarks.*
- *USEPA Region 3, 2006. USEPA Region 3 Biological Technical Assistance Group (BTAG) Screening Benchmarks. Marine Sediment Benchmarks. Mid Atlantic Risk Assessment, July 2006.*
- *USEPA Region 5, 2003. USEPA Region 5 Resource Conservation Recovery Act (RCRA) Ecological Screening Levels. August 22, 2003.*
- *USEPA Region 6, 1999. USEPA Region 6 Screening Level Ecological Risk Assessment Protocol. Appendix E: Toxicity Reference Values. Office of Solid Waste,*
- *Multimedia Planning and Permitting Division, Centre for Combustion Science and Engineering. August 1999.*
- *WA DOE cited in: Buchman, M.F., 2008 (update). National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SquiRT). NOAA HAZMAT Report, Seattle, WA, NOAA.*

- *Groundwater*
  - *USEPA, 2013. EPA Regional Human Health Screening Levels (RSLs). May 2013. Tapwater RSLs.*
- *Surface water*
  - *Buchman, 2008. Screening Quick Reference Table (SQuiRT). NOAA OR&R Report 08-1.*
  - *NYSDEC, 1998. New York State Department of Environmental Conservation. Division of Water Technical and Operational Guidance (TOGS) Series (1.1.1). Selected screening levels are for Class SD waters.*
  - *ODEQ, 1998. Guidance for Ecological Risk Assessment: Levels I, II, III, IV (Level II Screening Level Values). April 1998.*

- *Suter and Tsao, 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. ES/ER/TM-96/R2. June 1996.*
- *Texas Guidance, 2006. Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas RG-263.*
- *USEPA, 2009. National Recommended Water Quality Criteria for Priority Pollutants.*
- *USEPA, 2003. EPA Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013.*
- *USEPA Region 2, 2010. New York Freshwater and Marine Screening Benchmarks. Table provided by USEPA Region 2.*
- *USEPA Region 3, 2006. USEPA Region 3 Biological Technical Assistance Group (BTAG) Screening Benchmarks. Marine Benchmarks. Mid Atlantic Risk Assessment, July 2006.*
- *USEPA Region 4, 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001.*

If standards are not available in any of the sources listed above, site specific risk reduction standards (SSRRSs), as appropriate will be used.

If SSRRS are deemed more appropriate than the EPA Universal Industrial RSLs, they will be calculated upon completion of the sample collection portion of the investigation.

SSRRSs will be calculated using the formulas in the EPA Solid Waste and Emergency Response "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites", (OSWER 9355.4-24, December 2002). The equations that will be used for the calculation of industrial and construction SSRRSs are included in Appendix D.

- ***Confirm that appropriate measurement methods exist to provide the necessary data** – The soil/sediment, groundwater, and surface water will be tested using the methods listed in Table 2-1. The detection limits are adequate to achieve the results necessary for the actions described.*

***Step 4: Define the Boundaries of the Study** – a detailed description of the spatial and temporal boundaries of the problem, characteristics that define the populations of interest, and any practical considerations of interest.*

- ***Define the target population and geographic limits** – The target population is the set of all possible sampling units located within each AOC. The AOCs include: the Main Site (Former Refinery Units, Run Down Tanks, Leaded Fuel Handling Area,*

Open Storage Areas, and Former Waste Water Treatment Plant (WWTP) Components), Western Lagoons, Flores Peninsula, Oxochem/Caribe Isoprene, Eastern Lagoon, Area North of CPI No. 2, Tallaboa Pipeline, Main Site Active Pipeline, and the Caribe Isoprene Corporation Tank Area. Each of these areas is shown on Figure 1-3.

Soil/sediment, groundwater, and surface water samples will be collected from the locations shown in the figures from the RFI Work Plan listed in Table 1-3.

TABLE 1-3

Sample Collection Scheme

AOC	RFI Work Plan Figure Number	AOC	RFI Work Plan Figure Number
Main Site Groundwater	Figure 5-2	Jakes Lagoon	Figure 6-8
Main Site – Former Refinery Units / Run Down Tanks	Figure 5-9	Flores Peninsula	Figure 7-5
Main Site Former WWTP Components	As described at Oil Water Separator and DAF Unit	Oxochem/Caribe Isoprene	Figure 8-5
Main Site – Leaded Fuel Handling Area	Figures 5-15 and 5-16	Area N. of CPI No. 2, Eastern Lagoon, and Tallaboa River	Figure 8-5
Main Site – Open Storage Areas	Figures 5-9, 5-15, 5-16, 5-21, and 7-5	Mine Site Active Pipeline	At Areas of Visual Indications of Spills
Pump Stations	One Sample per Pump Station	Tallaboa Pipeline	At Areas of Visual Indications of Spills
Main Site Tanks and Northern Perimeter	Figure 5-10	Caribe Isoprene Corp. Tanks	Figure 8-5 and Figure 12-1

- ***Specify the temporal boundaries and other practical constraints*** *- The most important practical consideration that could interfere with the study is the ability to collect sufficient samples to meet the stated objectives. An additional practical constraint associated with sampling is the need to ensure that sampling conditions are safe for field staff. Therefore, sampling may not occur (or may be reduced or delayed) on days where atmospheric conditions raise a safety concern (e.g. thunderstorms, hurricanes).*
- ***Define the scale of decision making*** *– The scale will involve all of the soil analytical results from this investigation event and all previous soil analytical results from past investigations.*

Step 5: Develop The Analytic Approach *– to specify appropriate population parameters for making decisions or estimates; for decision problems, choose a workable Action Level and generate an "If…then…else" decision rule which involves it.*

- ***Specify the Action Level*** *- The action levels will be based on the EPA Universal Industrial RSLs, specific ecological standards (as defined on Worksheet #15 in Appendix A), or SSRRSs, as appropriate.*
- ***Specify the theoretical decision rule:***

1. *If the results for an individual AOC are below the Industrial RSLs or ecological standards, then recommend no further action.*
2. *If the results for an individual AOC are above the Industrial RSLs or ecological standards, then perform site specific risk assessment. Then compare results for that AOC to SSRRSs.*
3. *If results are below SSRRSs, then recommend no further action.*
4. *If results are above SSRRSs, then recommend risk assessment, corrective measures or CMS.*

Step 6: Specify Performance or Acceptance Criteria *– There is inherent uncertainty in any single sample due to variability in collection methods, how measurements are made and how analysis are performed, as well as other factors. To calculate the unacceptable risk in each AOC, the decision maker will evaluate the data, based on the 95% Upper Confidence Limit (UCL) estimate of the mean of the sample results and compare that to the Action Levels discussed in Step 5. According to the EPA "Risk Assessment Guidance for Superfund" (RAGS), Volume I, Human Health Evaluation Manual, Part A, EPA/540/1-89/002 December 1989, the concentration term in the intake equation is the arithmetic average of the concentration that is contacted over the exposure period. Although this concentration does not reflect the maximum concentration that could be contacted at any one time, it is regarded as a reasonable estimate of the concentration likely to be contacted over time. This is because in most situations, assuming long-term contact with the maximum concentration is not reasonable. Because of the uncertainty associated with any estimate of exposure concentration, the UCL (i.e., the 95% UCL) on the arithmetic average will be used for this variable.*

In those instances where it is appropriate to group sampling data from a particular medium, calculate for each exposure medium and each chemical the 95% UCL on the arithmetic average chemical concentration. One of the considerations in the determination of whether it is appropriate to group sampling data is the area over which receptors are likely to be exposed

(exposure domain). The exposure domain is the areal extent of the activity area of the receptor (i.e. a residential parcel may be the exposure domain for a child resident).

***Step 7: Develop the Plan for Obtaining Data** – identify alternative sampling and analysis designs that are appropriate for intended use, select and document a design that will yield data that will best achieve performance or acceptance criteria.*

- ***Select the sampling design** – The sampling locations for the different AOCs was developed through the utilization of Visual Sample Plan (VSP) Software Version 6.1b and EPA guidance for performing field sampling and making remedial decisions. The existing data were used in conjunction with the VSP software to assess the adequacy of the data for evaluating site conditions. An objective and null hypothesis are required when using VSP calculations; for the purpose of using VSP, the primary objective of site investigations and sampling analysis is to compare a site median or mean concentration with a fixed threshold criterion, such as the RSLs. Mean concentrations less than the screening criteria are assumed to present no potential risk to human; therefore, the working hypothesis (or 'null' hypothesis) for the data evaluation is that the median (mean) value of the contaminants in soil/sediment is less than the threshold criteria (RSL for industrial land use). The alternative hypothesis is that the median (mean) value is greater than or equal to the threshold criteria, which may indicate a potential risk to human receptors. The VSP Software Version 6.1b[2] calculates the number of samples required to reject the null hypothesis given a selected sampling approach, a 95% confidence interval, and other inputs to the associated equation. The number of samples deemed necessary for rejecting the null hypothesis can then be compared to any existing dataset and the need for supplemental data assessed. Using the data available for the different AOCs, VSP was utilized to determine if the existing data set is adequate to characterize the site soil; alternatively, if the existing data set is not adequate, the number of site soil samples that would be required was determined. A complete detail of the samples to be collected in each AOC can be found in Section 2.1.*

- ***Evaluating assumptions supporting the selected design** –The QA objectives of this project are to assess and document the precision, accuracy, representativeness, completeness, and comparability of all sampling and analyses performed. Criteria*

[2] The Visual Sample Plan Software was sponsored in part by various federal agencies including the U.S. Department of Energy; U.S. Department of Defense, Environmental Security Technology Certification Program; U.S. Department of Defense, Navy; U.S. Department of Health and Human Services' Centers for Disease Control & Prevention, National Institute for Occupational Safety and Health; U.S. Department of Homeland Security, Directorate for Science and Technology; and, EPA Offices of Environmental Information and Solid Waste and Emergency Response

are established herein to assure suitability for the intended use of data to be obtained during the investigation and to meet EPA-established goals. Definitive data has been chosen for this project. They provide laboratory analysis using standard EPA methodology and require documentation to assess data quality. Definitive data require QC forms to review data quality; however, 10% of the definitive data will be submitted with raw data due to the fact that the objective of this RFI is site characterization, and to determine, based on risk assessment whether interim corrective measures and/or a CMS are necessary.

1.6.2 Measurement Performance Criteria

1.6.2.1 Precision

"Precision" is defined as the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance, percent difference, or range, in either absolute or relative terms. Precision data indicate how consistent and reproducible the field sampling or analytical procedures have been.

Overall project precision is measured by collecting data from co-located field duplicate (or replicate) samples. Precision specific to the laboratory is measured by analyzing laboratory duplicate (or replicate) samples. Comparing overall project precision and laboratory precision will help to identify sources of imprecision if a problem exists. If only two separate samples are collected from adjacent locations and analyzed, these samples are referred to as *co-located field duplicates*. If two representative portions taken from a single sample are analyzed by the same laboratory, these are referred to as *subsample field duplicates*. If two aliquots of the same sample are prepared and analyzed by a laboratory, these samples are referred to as *laboratory duplicates*. If two aliquots of the same prepared sample are analyzed in duplicate, these samples are referred to as *analytical duplicates*. Duplicate precision is evaluated by calculating a relative percent difference (RPD) using the following equation (the smaller the RPD, the greater the precision):

$$RPD = \frac{A - B}{[(A + B)/2]} \times 100\%$$

Where:

RPD = relative percent difference
A = original sample concentration
B = duplicate sample concentration

If more than two duplicate samples are collected from adjacent locations and analyzed, these samples are referred to as *co-located field replicates*. If more than two representative portions are taken from a single sample and analyzed by the same laboratory, these samples are referred to as *subsample field replicates*. If two or more aliquots of the same sample are prepared and analyzed by a laboratory, these samples are referred to as *laboratory replicates*. If more than two aliquots of the same prepared sample are analyzed in replicate, these samples are referred to as *analytical replicates*. Replicate precision is evaluated by calculating the relative standard deviation (RSD), also referred to as the coefficient of variation, of the samples using the following equation (the smaller the RSD, the greater the precision):

$$\%RSD = \frac{\textit{Standard Deviation}}{\textit{Mean}} \times 100\%$$

Where:

$$s = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \overline{x})^2},$$

s = standard deviation
x_i = each individual value used for calculating the mean
x = the mean of n values
N = the total number of values

1.6.2.2 Accuracy

Accuracy is the degree of agreement between an observed value (sample result) and an accepted reference value; *bias* describes the systematic or persistent distortion associated with a measurement process. The terms *accuracy* and *bias* are used interchangeably in this document.

Analyte accuracy/bias can be evaluated using different types of QC samples. For example, a standard reference material or a laboratory control sample (LCS) that contains a known

concentration of analyte(s) spiked into contaminant-free water or other blank matrix provides information about how accurately the laboratory (analysts, equipment, reagents, etc.) can analyze for a specific analyte(s) using a selected method. Single-blind and double-blind proficiency testing (PT) samples also provide information on how accurately the laboratory can analyze for a specific analyte using a selected method. The cumulative laboratory and method accuracy/bias is calculated as a percentage using the following equation:

$$Accuracy/Bias = \frac{Measured\ Value}{Actual\ Value} \times 100\%$$

Because environmental samples contain interferences (i.e., other compounds that may interfere with the analysis of a specific analyte), the accuracy/bias for a specific analyte should be evaluated in relation to the sample matrix. This is done by analyzing matrix spike samples. A known concentration of the analyte is added to an aliquot of the sample. The difference between the concentration of the analyte in the unspiked sample and the concentration of the analyte in the spiked sample should be equal to the concentration of the analyte that was spiked into the sample. The spike recovery is calculated as a percentage using the following equation:

$$Accuracy/Bias = \frac{Spiked\ Sample\ Conc. - Unspiked\ Sample\ Conc.}{Spike\ Conc.\ Added} \times 100\%$$

Frequently, matrix spike samples are prepared and analyzed in duplicate, especially for organic analyses, to provide sufficient precision and accuracy data to evaluate achievement of project quality objectives.

1.6.2.3 Sensitivity and Quantitation Limit

Sensitivity is the ability of the method or instrument to detect the target analytes at the level of interest. The *quantitation limit* (QL) is the minimum concentration of an analyte that can be routinely identified and quantified above the method detection limit (MDL) for organic analyses and the instrument detection limit instrument detection limit (IDL) for inorganic analyses by a laboratory. Sensitivity can be measured by calculating the percent recovery of the analytes at the QL. The QLs for the RFI can be found in Appendix E of this QAPP.

Method and instrument sensitivity may be evaluated by preparing and analyzing a laboratory fortified blank (LFB). An LFB is a blank matrix that is spiked at the QL with the target analytes. Calibration curves should always include a standard concentration at the QL to ensure sensitivity. Low-point calibration standards should produce a signal at least 10 times the background level and should be part of a linear calibration curve.

1.6.2.4 Representativeness

Representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of a site. It takes into consideration the magnitude of the site area represented by one sample and indicates the feasibility and reasonableness of that design rationale. Representativeness also reflects the ability of the sample team to collect samples and the ability of the laboratory personnel to analyze those samples so that the generated data accurately and precisely reflect site conditions. In other words, a discrete sample that is collected and then subsampled by the laboratory is representative when its measured contaminant concentration equates to the contaminant concentration of some predefined vertical and horizontal spatial area at the site. Sample homogeneity, and sampling and subsampling variability, should be considered when developing criteria for representativeness. The use of statistical sampling designs and standardized SOPs for sample collection and analysis help to ensure that samples are representative of site conditions.

"Representativeness" expresses the degree to which data reflect actual environmental or process conditions. It is highly dependent upon the procedures and methods used to collect and analyze the samples. A representative sample can also be defined as one that represents the characteristics of the population defined in the project objective. Section 2.1 describes the sampling points in each AOC. The RFI, historical data, VSP, and data obtained throughout this investigation, will be used to select representative sample locations.

1.6.2.5 Comparability

Comparability is the degree to which different methods or data agree or can be represented as similar. It describes the confidence that two data sets can contribute to a common analysis and

interpolation. The objective of this QAPP is to produce a high level of comparability between data sets, although heterogeneous samples make it difficult to obtain consistently high comparability values. However, the use of standard methods for sampling and analysis (EPA protocols), reporting data in standard units, and using standard and comprehensive reporting formats will optimize the potential for high levels of data comparability.

1.6.2.6 Completeness

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness (%C) will be calculated by the following equation:

$$\%C = (N_A / N_I) \times 100$$

where:
%C = Percent completeness,
N_A = Actual number of valid environmental sample data, and
N_I = Number of environmental sample data collected.

CORCO will discuss and compare overall completeness of multiple data sets collected for the project for each matrix, analytical parameter and concentration level. CORCO will describe the limitation on the use of the project data if project required completeness was not achieved for the overall project or when it is limited to a specific sampling or laboratory/analytical group, data set, matrix, analytical parameter or concentration level. When project required completeness is not achieved and sufficient data are not available to adequately address environmental questions and support project decision making, then CORCO will address how this problem will be resolved and discuss the potential need for additional sampling.

Completeness will be calculated overall for each of individual nine AOCs. It should be noted that while the completeness objective is normally 95%, a lower completeness objective might be acceptable in situations where the samples are highly contaminated or where the sample matrices present severe analytical interference problems. If a particular AOC proves to be highly

contaminated (i.e. 90% of the sample results exceed the action levels), the completeness goal will be 90%. If the AOC is not highly contaminated, the completeness goal will be 95%.

1.6.2.7 Precision, Accuracy, and Completeness

The precision, accuracy, and completeness of field and laboratory measurements will be established through the use of the QA/QC practices described in this document in conjunction with the LQAP to be provided by Beckton Environmental Laboratories, Inc., the commercial off-site laboratory retained to support the project and the QA/QC procedures. This laboratory must meet the data quality objectives outlined in Section 4.2.3.1 of this QAPP and specified in SW-846 and other applicable EPA-stipulated methods. The precision, accuracy, and completeness objectives for each of the applicable analytical parameters for which laboratory analyses are anticipated are indicated in the SW-846 laboratory methods and the laboratory SOPs. Field duplicate precision should be $\pm$35 percent for soils and $\pm$20 percent for groundwater samples. If the field duplicate precision is outside the range, the Task Manager should be notified immediately. The project manager will initiate corrective action procedures as outlined in Section 3.1.2.

1.7 SECONDARY DATA EVALUATION

As previously described in Section 1.5.2 of this QAPP, the following reports and data were reviewed and analyzed as part of the development of the RFI Work Plan. These reports have been forwarded to EPA Region 2 with the EI submittal in late 2005.

A. Preliminary Assessment/Site Investigation Final Report, Addendum to Site Assessment Report Prepared by GDC Engineering Inc., dated August 31, 1994;
B. Site Assessment Report, Commonwealth Oil Refining Company Inc., Ponce, Puerto Rico, August 31, 1994;
C. Commonwealth Oil Refining Company, Phase I: Subsurface Oil Investigation Report, EPA I.D. PRD091017228, DSM Project No. 1012-01-01, November, 1994;
D. Monitor Well Installation, Monitor Well Plug & Abandonment, Eastern Oil Lagoon Impoundment Sampling & Monitor Well Level Measurement Addendum Project, February 8, 1995;

E. Eastern Oil Lagoon Area Groundwater Risk Analysis, DSM Project No. 1029, April 1995;
F. DSM Phase II: Subsurface Product Delineation Report, DSM Project No. 1035-01, February 1996;
G. DSM Phase II: Subsurface Product Delineation & Formation Evaluation Work Plan, EPA I.D. PRD09017228, Letter Report on the Findings of the Off-Property subsurface Product Delineation Program dated February 23, 1998;
H. DSM Phase II: Subsurface Product Recovery Simulation Report, DSM Project No. 116-01, April 1998;
I. DSM Phase II: Subsurface Product Recovery System Design, DSM Project No. 1125-01, dated August 14, 1998;
J. Environmental Status Report, Shell Fuel Terminal, Guayanilla, Puerto Rico, DSM Project No. 1130-01, dated October 6, 1998;
K. CORCO Phase II Environmental Site Assessment, CSA Group, November 2000;
L. Soil Sampling of Former UST Areas, CORCO Facility, Peñuelas, PR, GeoEnviroTech, Inc., dated January 13, 2003;
M. Historical Free Production Evaluation, CORCO, NewFields, April 2004;
N. Monitoring Wells Installation and Groundwater Sampling at Oxochem/Caribe Isoprene, Peñuelas, PR, On-Site Environmental, July 2005;
O. Potential Receptor Evaluation – Mangrove Land Crabs in the Effluent Channel Area at CORCO, Peñuelas, PR, On-Site Environmental, August 2005;
P. Tier 2 and 3 Subsurface Vapor Intrusion Screening at CORCO, On-Site Environmental, August 2005;
Q. Results of a Site Assessment Program for Environmental Indicators, Main Site, CORCO, Peñuelas, PR, AGES, September 2005;
R. Results of a Site Assessment Program for Environmental Indicators, Jakes Lagoon, CORCO, Peñuelas, PR, AGES, September 2005;
S. Results of a Site Assessment Program for Environmental Indicators, Flores Park, CORCO, Peñuelas, PR, AGES, September 2005;
T. Health and Safety Plan, Peñuelas, PR, NewFields, September 2005;
U. Screening Level Human Health Risk Evaluation of Land Crab Consumption Exposure Pathway, CORCO, Peñuelas, PR, NewFields, September 2005;
V. Documentation of Environmental Indicators Determination, EPA I.D. No. PRD091017228, EPA Region 2, November 2005;
W. January 2004 Through December 2005 Free Product Monitoring Report, CORCO, Peñuelas, PR, NewFields, May 2006;
X. Results of a Sediment Sampling Program, Eastern and Western Oil Lagoons, CORCO, Peñuelas, PR, AGES, October 2006;
Y. January 2006 Through December 2006 Free Product Monitoring Report, CORCO, Peñuelas, PR, NewFields, May 2007; and,
Z. Decommissioning, Deconstruction, and Demolition of Abandoned Refinery Units, Draft Report, CORCO, Peñuelas, PR, NewFields, September 2003.

All previous data is presented in Tables 5-1 to 9-2 and Figures 5-1 to 9-4 in the RFI Work Plan.

1.8 PROJECT OVERVIEW AND SCHEDULE

1.8.1 Project Overview

The purpose of the RFI Work Plan and this QAPP is to fully characterize the nature, extent and rate of migration of releases, if any of hazardous waste or constituents of all nine AOCs at the CORCO facility. The investigation will encompass the collection of soil and groundwater samples to delineate the nine AOCs.

The target analytes or contaminants of concern (COCs) to be collected and analyzed, their action levels, QLs, Analytical Method Limits, and Achievable Laboratory Limits are listed in Worksheet #15 located in Appendix A. The list of target analytes may increase or decrease as the project progresses depending on the findings of the field instruments to be utilized during the investigation. These field instruments are described in Section 2.1.

1.8.2 Project Schedule

Sampling activities will begin at a time subject to EPA approval of the RFI Work Plan. The schedule for the entire RFI is listed in Figure 1-5.

2.0 MEASUREMENT AND DATA ACQUISITION

2.1 SAMPLING TASKS

2.1.1 Sampling Process Design and Rationale

The samples proposed are designed to provide sufficient data, when combined with available existing data, to meet the purpose of the RFI Work Plan.

> The purpose of the RFI is to obtain information to fully characterize the nature, extent and rate of migration of releases, if any, of hazardous waste or constituents and to interpret this information to determine, based on risk assessment, whether interim corrective measures and/or a CMS are necessary.

Each AOC was then categorized into one of three possible RFI Action Plans. The Action Plans are based on past and present area usage and availability of data for risk assessment. This was necessary due to the fact that existing data coverage varies widely from area to area. The three Action Plans are:

Action Plan 1

Data coverage is sufficient and all sample results are less that the corresponding EPA Industrial RSLs. No further action is recommended for each AOC.

Action Plan 2

Data coverage is sufficient and a risk assessment has been performed and included in this document. Based on the area-specific risk assessment the risks are acceptable based on current and future anticipated use. Therefore no further action is recommended.

Action Plan 3

Data coverage is insufficient to perform risk assessment or no data has been collected. CORCO will collect additional data in accordance with the proposed sampling scope of work. Based on the results of the sample analysis, risk assessment will be performed, as necessary, to determine whether additional actions are required. Thereafter, a description of action items will be created, if needed.

2.1.1.1 Area 1 - CORCO Main Site - Main Tank Farm and Ancillary/Support Activities and Services, and Former Refinery Units Located North and South of Highway 127

2.1.1.1.1 Groundwater

Action Plan 3. Past trends in the free product plume extent and thickness have indicated a continuing decrease over time. As the free product plume continues to be reduced, it is appropriate to begin dissolved product monitoring of boundary conditions in select locations at the site where there is no free product present. The purpose of this dissolved monitoring is to establish a time series data record to evaluate trends. Wells where free product is observed will not be sampled for dissolved constituents. CORCO proposes to sample the wells located at Jakes Lagoon as described in Section 6.5.3.2 of the RFI Work Plan. The Jakes Lagoon wells provide a boundary between the site wide plume and Guayanilla Bay to the west.

With regard to the boundary with former Union Carbide property, no further sampling for dissolved constituents will be taken due to the presence of trace amounts of free product. CORCO has installed wells along the boundary with Shell and free product remains present in many of these boundary wells. Therefore no dissolved product sampling will be performed here until free product recovery is complete.

2.1.1.1.2 Former Refinery Units

Action Plan 3. Once the refinery units have been decommissioned and decontaminated as part of the decommissioning, deconstruction and demolition (DD&D) process, an area wide soils screening will be performed, including sampling of surface and subsurface soils for impacts from the former refinery units. The samples will be collected at the refinery units using a traditional auger type rotary drill rig, a portable auger rig, a hand auger and/or geoprobe DPT rig for sample collection depending on site access limitations, cost and equipment availability.

Field Screening

A hand held photoionization detector (PID) will be used to screen the samples as they are collected. The purpose of the PID is to identify hot spots for volatile contamination. The PID will also be used to identify the location for sample collection in the vertical sample core. The

PID has a detection limit of 1 part per million (ppm) for total volatile organic compounds (VOCs). This detection limit is sufficient for source delineation and high mass migration given the levels expected for screening purposes. The borings will be advanced to a 1 foot depth if they are for ecological risk only and up to 10 feet depth if they are for human health risk. Borings will be advanced to the designated depth or groundwater, whichever occurs first. A surveyor or GPS will be used to locate the sample points. Additional boring locations may be added as needed to delineate areas of concern. The rationale for the sample intervals is provided below:

1. Zero to 1 foot bgs – Eco risk and human health surface soil exposure risk,
2. 1 to 4 feet bgs – Human health site personnel and trench exposure risk,
3. 4 to 10 feet bgs – Human health construction (foundations or basement) worker exposoure risk.

A surveyor or GPS will be used to locate the sample points. Additional boring locations may be added as needed to delineate areas of concern.

A field hand held X-ray fluorescence (XRF) device will be used to field screen for metals. The top 1 inch of soil will be removed and a hand auger used to collect the upper 6 inches of soil. The soils will be thoroughly mixed and screened using the XRF. Ten percent of the metals soils screening results will be sampled and sent to the laboratory for RCRA metals analysis. These lab results will be used to correlate the field XRF results with lab metals results for risk assessment. If the initial upper 6 inch screening with the XRF exceeds the industrial standards, or estimated background concentrations, for any of the eight metals, additional 1 foot sample intervals will be collected and measured using the XRF. The screening will continue vertically until the results indicate that all eight metals are below industrial standards or estimated background.

Laboratory Analysis Samples

After PID/XRF screening of the sample core a grab sample will be collected from each of the designated sample intervals for lab analysis. The sample intervals are 0 – 1 feet below ground surface (bgs) for ecological and human health risk locations, and 1 to 4 feet bgs and 4 to 10 feet bgs for human health risk locations. The grab sample for each sample interval will be collected

from the portion of the sample associated with the highest PID reading. The grab sample will be analyzed at the lab for VOCs, SVOCs, and fractioned total petroleum hydrocarbons (TPH) [volatile petroleum hydrocarbons (VPH) and extractable petroleum hydrocarbons (EPH)]. Approximately 10 percent of the soil samples will be sent to the laboratory for RCRA metals analysis. These lab results will be used to correlate the field XRF results with metals concentrations for risk assessment.

Laboratory Sample Hold and Release for Analysis

In an effort to reduce the number of redundant samples analyzed, samples from the 4 – 10 feet intervals will be collected in the field as designated in the sampling plan. The 4 – 10 feet samples will be shipped to the lab and held pending the results of the 1 – 4 feet interval above it. If the upper interval sample meets applicable RSLs, then the lower interval will not be analyzed. If the upper interval sample fails RSLs, then the lower interval will be analyzed. Extractions and analyses will be completed as needed to maintain appropriate hold times.

Proposed Sampling Locations and Rationale for Number of Samples

The approximate boring locations for the refinery area and run down tanks are shown in Figure 5-9 of the RFI Work Plan. The sampling program for the former refinery units was developed through the utilization of VSP Software Version 6.0 and EPA guidance for performing field sampling and making remedial decisions. In addition to the locations shown in Figure 5-9, two additional boring will be installed through the slab to a depth of 10 feet bgs each. These borings will be installed through the slab in a low spot or along cracks locations of likely leakage of process wastes from refinery operations. These boring will be field located.

2.1.1.1.3 Inactive Storage Tanks

Action Plan 3. In order to complete the human and ecological risk assessments, additional samples are proposed around Tanks, 704, 727, 604, 741, 903, 926, 932, 934, 933, 972, 978, 997, 998, 1001, 1002, 1007, 1013, 1022, 1023, TK-1, TK-2, T-1, T-2, T-3, T-4, and E-1, as well as along the northern perimeter of the Main Site. The locations of these proposed samples can be seen in Figure 5-10 of the RFI Work Plan. The rationale for selecting these locations was to; 1)

select representative tanks based on historical tank contents, 2) sample most and least likely locations within the selected tank containment dikes, and 3) use these sample results to represent the remaining tanks for the purposes of risk assessment and corrective action.

2.1.1.1.4 Leaded Fuel Handling Area

Action Plan 1 and 3. Tanks 955 through 958 and 1001 through 1006, have been previously sampled by CSA Group, pose no risk and therefore no further action is proposed.

Borings are proposed for Tanks 927, 928, 929, 930, 959, 960 and 1014 mentioned above. Figure 5-15 of the RFI Work Plan shows the approximate locations of the proposed borings. Samples will be collected around the perimeter of the product storage tanks. One sample will be collected close to the man way, where feasible. All samples will follow the protocol outlined in sampling proposed for the Refinery Units.

The two USTs are registered with PREQB and will not be addressed in this RFI but in accordance with PREQB regulations.

2.1.1.1.5 Former Drum Storage Area 3 – Pump House #5

Action Plan 3. No surface soil samples have been collected in this area and some of the subsurface samples have had results greater than industrial standards. Therefore borings are proposed for assessment of human health risk. This area will be sampled as indicated in Figure 5-16 of the RFI Work Plan, which were based on the prior sampling results which indicated the southeast corner of the area may be impacted above RSLs. The borings will be advanced to 10 feet depth or groundwater elevation whichever occurs first. All samples will follow the protocol outlined in sampling proposed for the refinery units.

2.1.1.1.6 Open Storage Areas

Action Plan 3. Existing data indicates that subsurface areas do not present a risk. Additional surface sampling is proposed for each of the Open Storage Areas. Figure 5-21 of the RFI Work

Plan shows the approximate locations of the proposed borings in the Former Drum Storage Areas 1 and 2 and the Western Lagoon Scrap Yard. Former Drum Storage Area 4 is covered by the Former Refinery Units sampling and Drum Storage Area 3 is covered by Pump House 5 sampling. The Flores Peninsula Storage Area is covered by sampling proposed for Flores Peninsula. The boring installation and sampling protocol is the same as that described for the refinery units.

2.1.1.1.7 Former Waste Water Treatment Plant Components

Action Plan 3. Additional soil samples are proposed for each of these units. For the former API OWS, four borings are proposed, one on each side of the unit. The DAF screening samples with four borings evenly distributed around the perimeter of the former DAF unit. In addition, one boring will be collected beneath the DAF unit. The borings will be installed and sampled as described in the Refinery Units section. All borings will be advanced to 10 feet below ground surface or the water table, whichever occurs first.

2.1.1.2 Area 2 - Western Lagoons - former wastewater treatment facility

Action Plan 3. The available data does not provide information on the sample depth intervals necessary to complete the ERA and HHRA. Therefore Action Plan 3 is chosen for the Western Lagoons to collect the data needed. The proposed sample locations are shown in Figure 6-8 of the RFI Work Plan. The number of samples proposed was selected based on the need to adequately characterize the individual lagoons and the effluent channel. Best professional judgment was used along with the existing data to conclude that the lagoon sediments are relatively consistent within lagoon.

Sampling of the borings in non-lagoon areas of the WL will be by drilling as described for the Refinery Units. For the lagoon samples, these will be partially wet or underwater and will need to be collected with specialty equipment as described in Attachment C of the RFI Work Plan. Surface water present in the Aeration Basin and the Effluent Channel will be sampled at approximately the same location as the sediment borings. The surface water samples will be analyzed for the same parameters as the sediment samples.

2.1.1.2.1 Tank 1007

Action Plan 3. Two boring will be installed at Tank 1007 as shown on the Figure 6-8 of the RFI Work Plan. These borings will be installed and sampled as those in the Refinery Unit. Given the possibility that acid waste disposal has occurred in this area, CORCO proposes to further evaluate this area by collecting additional pH screening samples.

2.1.1.2.2 Jakes Lagoon

2.1.1.2.2.1 Soil

Action Plan 3. CORCO proposes to sample the materials in Jake's Lagoon areas to determine whether impacts are present and to delineate these impacts. Borings will be collected from the locations shown in Figure 6-8 of the RFI Work Plan. The borings will be advanced to 10 feet depth or groundwater, whichever occurs first. A hand held GPS device will be used to record the approximate location of each aliquot collected so that the resulting sample location can be plotted. Additional borings may be added based on the results of the screening samples as needed for delineation. Surface water present in the southern portion of Jakes lagoon will be sampled at approximately the same locations as the 4 wet sediment samples (Figure 6-8 of the RFI Work Plan).

2.1.1.2.2.2 Groundwater

Action Plan 3. CORCO proposes to perform as part of this RFI, dissolved constituent sampling of the groundwater monitoring wells at Jake's Lagoon. The reason is that these wells represent the boundary of Jake's Lagoon, the Main Site and Western Lagoon free product/dissolved product plume at Guayanilla Bay. The sampling will include all the JL series monitoring wells. If free product is encountered in any wells, those wells will not be sampled, but the product thickness will be recorded. Samples from each well without free product will be analyzed for SVOCs and VOCs. RCRA metals analysis may be included if soil sampling results suggest the presence of significant levels of leachable metals at Jake's Lagoon. One time dissolved constituent sampling as previously described will be performed to establish a baseline.

2.1.1.3 Area 3 - Flores Peninsula at Guayanilla Bay

Action Plan 3. Additional borings are proposed for the peninsula as shown in Figure 7-5 of the RFI Work Plan. The number of samples proposed is based on an understanding of the use of the subareas, existing data and for delineation purposes as necessary. In addition, VSP was used to confirm that the number of samples were adequate. The borings will be advanced to depth of 10 feet or groundwater whichever occurs first.

The existing groundwater monitoring well network adequately covers Flores Peninsula with 17 monitoring wells located around the southern perimeter of the peninsula. CORCO proposes to perform a onetime sampling event of the perimeter FP wells. Each well will be sampled and analyzed for SVOCs and VOCs. RCRA metals analysis may be included if soil sampling results suggest the presence of significant levels of leachable metals at FP.

2.1.1.4 Area 4 - Oxochem and Caribe Isoprene Corporation (OXO/CIC)

Action Plan 3. Existing subsurface soil samples cover the OXO/CIC area adequately for BTEX compounds. CORCO proposes limited additional sampling in select areas for which there is limited existing data (see Figure 8-5 of the RFI Work Plan). The number of samples proposed is based on an understanding of the use of the subareas, given the low values of the existing data and the fact that additional samples may be added for delineation purposes. The former wastewater lagoon at Oxochem is located in the northern portion of the site. Given the close proximity of the Tallaboa River, and the potential for flooding at this site, CORCO proposes to sample the former pond in the locations as indicated. A former drum under roof storage area in the northeast corner of Oxochem is also proposed for sampling. Each boring location will be installed and sampled as described for the Refinery Units. Subsurface samples will only be analyzed for RCRA metals, VPH and EPH because existing data coverage is sufficient for VOCs and SVOCs. Borings will extend to 10 feet below grade or to groundwater, whichever occurs first. Additional borings may be added during the field activities as needed to complete the delineation.

2.1.1.5 Tallaboa River

Action Plan 3. CORCO proposes to collect a total of 7 sediment samples in the Tallaboa River upstream, adjacent to and downstream of the Oxochem/CIC sites. The purpose of these samples is to evaluate Ecological risks that may be attributable to CORCO operations. These samples will be collected over the 0 – 1 foot interval and analyzed for VOCs, SVOC, VPH/EPH, TPH and RCRA metals. Please note, the Tallaboa River has many potential sources for pollutants upstream of the Site that include both point and non-point sources.

2.1.1.6 Area 5 - Eastern Lagoon

Action Plan 3. CORCO proposes to install the borings shown on Figure 8-5 of the RFI Work Plan for the EL. The borings will be installed and sampled as those described for the Refinery Units. The borings will be advanced to 10 feet or to groundwater whichever occurs first.

The groundwater wells will not be sampled at the EL pending results of the soils sampling.

2.1.1.6 Area 6 – Area North of CPI No. 2

Action Plan 3. CORCO proposes to install the borings shown on Figure 8-5 of the RFI Work Plan. The borings will be installed using hand augers to one foot depth. These samples will be field screened with the PID and XRF. The analysis performed will be as those described for the Refinery Units. The samples located adjacent to the transformer station will be analyzed for PCBs.

2.1.1.7 Area 7 – Tallaboa Pipeline

Action Plan 3. CORCO will identify areas of soils underneath these pipelines that by visual observation suggest the occurrence of spills. Soil samples will be collected from these selected locations. If the area of visual impact is less than 10 meters in any direction a single grab sample will be collected. If the area is greater than 10 meters in any direction, then four aliquots will collected evenly distributed across the impacted area. Additional samples may be added if the impacted area is greater than 20 meters in any direction.

The composite of the four aliquots will be screened for metals using the XRF. One sample aliquot, which has the highest PID field screening result, will be analyzed for VPH/EPH, VOCs and SVOCs. Ten percent of all samples will be collected at depths of 0 to 1 ft bgs. Deeper sample intervals may be collected from 1 ft to 4 ft bgs based on PID results in the surface sample and visual evidence suggesting possibility of vertical migration. Each of the sample aliquots that make up the composite sample will also be sent to the lab, but will be held for analysis based on the results of the composite sample. The individual sample aliquots may be analyzed to pinpoint the location of contamination, if any.

A portion of the pipelines are covered by the site wide groundwater monitoring network. For remaining outlying areas not covered by the Main Site groundwater, if it is determined that there are no contamination problems in subsurface soil, there is no groundwater issue.

2.1.1.8 Pump Stations

Action Plan 3. One sample is proposed for each of the 39 pump stations. Each of these samples will be collected at the depth of 0 to 1 ft bgs. Deeper sample intervals may be collected from 1 ft to 4 ft bgs based on visual evidence suggesting possibility of vertical migration. Each sample will be analyzed for VOC, SVOCs and RCRA metals. The location of each sample within the pump station areas will be based on visual evidence of spills.

2.1.1.9 Area 8 – Main Site Active Pipeline

Action Plan 3. CORCO will identify areas of soils underneath these pipelines that by visual observation suggest the occurrence of spills. Soil samples will be collected from these selected locations. If the area of visual impact is less than 10 meters in any direction a single grab sample will be collected. If the area is greater than 10 meters in any direction, then four aliquots will collected evenly distributed across the impacted area. Additional samples may be added if the impacted area is greater than 20 meters in any direction.

The composite of the four aliquots will be screened for metals using the XRF. One sample aliquot, which has the highest PID field screening result, will be analyzed for VPH/EPH, VOCs and SVOCs. Ten percent of all samples will be collected at depths of 0 to 1 ft bgs. Deeper sample intervals may be collected from 1 ft to 4 ft bgs based on PID results in the surface sample and visual evidence suggesting possibility of vertical migration. Each of the sample aliquots that make up the composite sample will also be sent to the lab, but will be held for analysis based on the results of the composite sample. The individual sample aliquots may be analyzed to pinpoint the location of contamination, if any. Extractions and analyses will be completed as needed to maintain appropriate hold times.

A portion of the pipelines are covered by the site wide groundwater monitoring network. For remaining outlying areas not covered by the Main Site groundwater, if it is determined that there are no contamination problems in subsurface soil, there is no groundwater issue.

2.1.1.10 Area 9 – Caribe Isoprene Corporation Tanks

Action Plan 3. Borings will be installed at the locations shown in Figure 12-1 of the RFI Work Plan. The borings will be installed and sampled as those described for the Refinery Units. Borings will be advanced to 10 feet below ground surface or to groundwater whichever occurs first.

2.1.2 Sampling Procedures and Requirements

The sampling procedures are modeled after those presented in the EPA Region 4 Field Branches Quality System and Technical Procedures (FBQSTP), Science and Ecosystem Support Division (SESD), May 2009, and the EPA Region II CERCLA QAM, October 1989. Procedures for the collection of representative samples will include:

- Ensuring that the sample collected is representative of the media being sampled;
- Using proper sampling, sample handling, preservation, and quality control techniques;

- Properly identifying the collected samples and documenting the collection in permanent field records (field log books, chain of custody records, etc.); and,
- Maintaining sample chain-of-custody.

2.1.2.1 Sampling Collection Procedures

The procedures found in the FBQSTP contain routine field sampling and measurement procedures, and quality control documents used by field investigators of the two SESD Field Branches: the Ecological Assessment Branch and the Enforcement and Investigations Branch.

The specific sampling and field measurement procedures are based on the experience of the field investigators within the field branches and accepted professional practices which are referenced in each procedure.

The following SOPs will be utilized during the RFI and can be found in Appendix G:

- Sediment Sampling (#SESD-PROC-200-R2);
- Surface Water Sampling (SESD-PROC-201-R1);
- Pump Operation (#SESD-PROC-203-R2);
- Soil Sampling (#SESD-PROC-300-R1);
- Groundwater Sampling (#SESDPROC-301-R1);
- Waste Sampling (#SESD-PROC-302-R1);
- Ambient Air Sampling (#SESDPROC-303-R3); and,
- Wastewater Sampling (#SESD-PROC-306-R2).

2.1.2.1.1 Special Precautions for Trace Contaminant Soil Sampling

All soil sampling equipment used for sampling trace contaminants should be constructed of inert materials such as stainless steel where possible. Pans used for mixing should be Pyrex® (or equivalent) glass. In no case will chromium, cadmium, galvanized, or plated equipment be used for soil sampling when trace levels of inorganic contaminants are of concern. Similarly, no painted or plastic equipment may be used where trace levels of organic contaminants are of concern. Paint, scaly or heavy rust and grease must be removed before use, most often by

sandblasting the equipment. Ancillary equipment such as auger flights may be constructed of other materials since this equipment does not come in direct contact with the samples.

Some contaminants can be detected in the parts per billion and/or parts per trillion range. Extreme care must be taken to prevent cross-contamination of these samples. The following precautions shall be taken when trace contaminants are of concern:

- A clean pair of new, non-powdered, disposable latex gloves will be worn each time a different location is sampled and the gloves should be donned immediately prior to sampling. The gloves should not come into contact with the media being sampled. Please see the project Health & Safety Plan for additional precautions.

- Sample containers for source samples shall be placed in separate plastic bags immediately after collecting, tagging, etc.

- If possible, ambient samples and source samples should be collected by different field teams. If different field teams cannot be used, all ambient samples shall be collected first and placed in separate ice chests or shipping containers. Samples of waste or highly contaminated samples shall never be placed in the same ice chest as environmental samples. Ice chests or shipping containers for source samples or samples suspected to contain high concentrations of contaminants shall be lined with new, clean, plastic bags.

- If possible, one member of the field sampling team should take all the notes; fill out sample labels, etc., while the other members collect the samples.

- When sampling surface waters, the surface water sample should always be collected before the sediment sample is collected. Both the surface water and sediment samples will be collected starting with the downstream location first and will then move in an upstream direction, until all of the samples are collected.

- Sample collection activities should proceed progressively from the least suspected contaminated area to the most suspected contaminated area.

- Investigators should use equipment constructed of Teflon®, stainless steel, or glass that has been properly pre-cleaned for collection of samples for trace metals or organic compounds analyses. Teflon® or glass is preferred for collecting samples where trace metals are of concern. Equipment constructed of plastic or PVC shall not be used to collect samples for trace organic compounds analyses.

- All pans or bowls, whether they are glass or stainless steel, used for sample collection will be decontaminated before use and between sample points as described in Section 2.1.2.3.9.

2.1.2.1.2 Surface Soils

Surface soils may be collected with a wide variety of equipment, if constructed of appropriate materials. Spoons or hand-augers are typically used to collect surface soil samples. If a thick, matted root zone is encountered at or near the surface, it should be removed before the sample is collected. The collected soil is placed in a pan, thoroughly mixed, and placed in the appropriate sample container(s) as described in EPA Region 4 EPA SESD Soil Sampling SOP (SESDPROC-300-R1).

2.1.2.1.3 Subsurface Soils

Hand augers are the most common equipment used to collect shallow subsurface samples. Typically, 4-inch auger-buckets with cutting heads are pushed and twisted into the ground, then removed as the buckets are filled. The auger holes are advanced one bucket at a time. The practical depth of investigation using a hand-auger depends upon the soil properties. In sand, auguring is usually easily performed, but the depth of collection is limited to the depth at which the sand begins to flow. At this depth, the bore hole will usually collapse and cannot be advanced. Deeper sampling must be accomplished using power equipment. Hand auguring may also be of limited use in tight clays or cemented sands. Regardless of the soil type, at depths approaching 20 feet sidewall friction may become so severe that power equipment must be used.

If the borehole is advanced using a hand auger, upon reaching the desired sampling depth replace the bucket with a properly decontaminated bucket. The sample may then be collected. After the sample has been collected, the borehole may be advanced (if necessary) with the bucket that was used to collect the sample. Each sample must be collected using a properly decontaminated bucket.

Before the soil is placed in a pan, it is necessary to remove the top several inches of soil to minimize the possibility of cross-contamination of the sample from fall-in of material from the upper portions of the hole. Once the soil is placed in a pan, it is thoroughly mixed, and placed in the appropriate sample container(s) as described in EPA Region 4 EPA SESD Soil Sampling SOP (SESDPROC-300-R1).

2.1.2.1.4 Direct Push Rigs

For surface soil samples where the ground is too hard or is covered by asphalt, and subsurface sampling where hand auguring is not appropriate, Direct Push Technology (DPT) will be used to extent feasible to collect the samples. This method uses a standard split-spoon modified with a locking tip which keeps the spoon closed during the sampling push. Upon arrival at the desired depth, the tip is remotely released and the push continued. During the push, the released tip moves freely inside of the spoon as the soil core displaces it. This technique is particularly beneficial at highly contaminated sites, because no cuttings are produced. The push rods are generally retrieved with very little residue resulting in minimal exposure to sampling personnel and reduced Investigation Derived Waste (IDW).

Before the soil is placed in a pan, it is necessary to remove the top several inches of soil to minimize the possibility of cross-contamination of the sample from fall-in of material from the upper portions of the hole. Once the soil is placed in a pan, it is thoroughly mixed, and placed in the appropriate sample container(s) as described in EPA Region 4 EPA SESD Soil Sampling SOP (SESDPROC-300-R1).

2.1.2.1.5 Groundwater

Purging is the process of removing stagnant water from a monitoring well, immediately prior to sampling, causing its replacement by ground water from the adjacent formation, which is representative of actual aquifer conditions. In order to determine when a well has been adequately purged, field investigators should:

- Monitor the pH, specific conductance, temperature, and turbidity of the ground water removed during purging; and
- Observe and record the volume of water removed.

Prior to initiating the purge, the amount of water standing in the water column (water inside the well riser and screen) should be determined. To do this, the diameter of the well should be determined and the water level and total depth of the well are measured and recorded. Once this information is obtained, the volume of water to be purged can be determined using one of several methods. One is the equation:

$$V = 0.041\ d2h$$

Where:

h = depth of water in feet
d = diameter of well in inches
V = volume of water in gallons

With respect to volume, an adequate purge is normally achieved when three to five times the volume of standing water in the well has been removed. The field notes should reflect the single well volume calculations or determinations, according to one of the above methods, and a reference to the appropriate multiplication of that volume, i.e., a minimum three well volumes, clearly identified as a purge volume goal.

With respect to the ground water chemistry, an adequate purge is achieved when the pH, specific conductance, and temperature of the ground water have stabilized and the turbidity has either stabilized or is below 10 Nephelometric Turbidity Units (NTUs) (twice the Primary Drinking Water Standard of 5 NTUs). Although 10 NTUs is normally considered the minimum goal for most ground water sampling objectives, 1 NTU has been shown to be easily achievable and reasonable attempts should be made to reach this level. Stabilization occurs when pH measurements remain constant within 0.1 Standard Unit (SU), specific conductance varies no more that 10 percent, and the temperature is constant for at least three consecutive readings. There are no criteria establishing how many sets of measurements are adequate for the determination of stability. If the calculated purge volume is small, the measurements should be taken frequently to provide a sufficient number of measurements to evaluate stability. If the purge volume is large, measurements taken every 15 minutes may be sufficient.

If, after three well volumes have been removed, the chemical parameters have not stabilized according to the above criteria, additional well volumes (up to five well volumes), should be removed. If the parameters have not stabilized within five volumes, it is at the discretion of the project leader whether or not to collect a sample or to continue purging. If after five well volumes, pH and conductivity have been stabilized and the turbidity is still decreasing and

approaching an acceptable level, additional purging should be considered to obtain the best sample possible. The conditions of sampling should be noted in the field log.

Attempts should be made to avoid purging wells to dryness. This can be accomplished, for example, by slowing the purge rate. If a well is pumped dry, it may result in the sample being comprised partially of water contained in the sand pack, which may be reflective, at least in part, of initial, stagnant conditions. In addition, as water re-enters a well that is in an evacuated condition, it may cascade down the sand pack or the well screen, stripping volatile organic constituents that may be present and/or introducing soil fines into the water column.

It is particularly important that wells be sampled as soon as possible after purging. If adequate volume is available, the well must be sampled immediately. If not, sampling should occur as soon as adequate volume has recovered.

Monitoring well purging is accomplished by using in-place plumbing and dedicated pumps or, by using portable pumps/equipment when dedicated systems are not present. The equipment may consist of a variety of pumps, including peristaltic, large and small diameter turbine (electric submersible), bladder, centrifugal, gear-driven positive displacement, or other appropriate pumps. The use of any of these pumps is usually a function of the depth of the well being sampled and the amount of water that is to be removed during purging. Whenever the head difference between the sampling location and the water level is less than the limit of suction and the volume to be removed is reasonably small, a peristaltic pump should be used for purging.

The low flow/low volume purging is a procedure used to minimize purge water volumes. The pump intake is placed within the screened interval at the zone of sampling, preferably, the zone with the highest flow rate. Low flow rate purging is conducted after hydraulic conditions within the well have re-stabilized, usually within 24 to 48 hours. Flow rates should not exceed the recharge rate of the aquifer. This is monitored by measuring the top of the water column with a water level recorder or similar device while pumping.

The peristaltic pump/vacuum jug can be used for sample collection because it allows for sample collection without the sample coming in contact with the pump tubing. This is accomplished by placing a Teflon® transfer cap assembly onto the neck of a standard cleaned 4-liter (1-gallon) glass container. Teflon® tubing (¼-inch O.D.) connects the container to both the pump and the sample source. The pump creates a vacuum in the container, thereby drawing the sample into the container without it coming into contact with the pump tubing.

Samples for VOC analysis should be collected by filling the Teflon® tube, by one of two methods, and allowing it to drain into the sample vials. The tubing can be momentarily attached to the pump to fill the tube with water. After the initial water is discharged through the pump head, the tubing is quickly removed from the pump and a gloved thumb placed on the tubing to stop the water from draining out. The tubing is then removed from the well and the water allowed to either gravity drain or is reversed, by the pump, into the sample vials. (Note: When reversing the pump, make sure the discharge tubing is not submerged in purge water. This will prevent introducing potentially cross-contaminated purge water into the sample.) Alternatively, the tubing can be lowered into the well the desired depth and a gloved thumb placed over the end of the tubing. This method will capture the water contained in the tubing. It can then be removed from the well and the water collected by draining the contents of the tubing into the sample vials. Under no circumstances should the sample for volatile organic compound analysis be collected from the content of any other previously filled container.

When sampling for metals only, it is also permissible to collect the sample directly from the pump discharge tubing after an adequate purge has been demonstrated. When collecting samples in this manner there are several considerations to be aware of. The pump head tubing (silastic, etc,) must be changed after each well and a rinsate blank must be collected of a representative piece of the pump head tubing. Also, precautions must be taken to ensure that the end of the discharge tubing is not allowed to touch the ground or other surface to ensure the integrity of the sample collected in this manner.

2.1.2.1.6 Sample Handling and Mixing

After collection, all sample handling should be minimized. Investigators should use extreme care to ensure that samples are not contaminated. If samples are placed in an ice chest, investigators should ensure that melted ice cannot cause the sample containers to become submerged, as this may result in sample cross-contamination. Plastic bags, such as Zip-Lock® bags or similar plastic bags sealed with tape, should be used when small sample containers (e.g., VOC vials or bacterial samples) are placed in ice chests to prevent cross-contamination.

Once a sample has been collected, it may have to be transferred into separate containers for different analyses. The best way to transfer liquid samples is to continually stir the sample contents with a clean pipette or precleaned Teflon® rod and allow the contents to be alternately siphoned into respective sample containers using Teflon® or PVC (Tygon® type) tubing (and a siphon bulb to start the flow). Teflon® must be used when analyses for organic compounds or trace metals are to be conducted. Any device used for stirring, or tubing used for siphoning, must be cleaned in the same manner as other equipment. However, samples collected for volatile organic compound, oil and grease, bacteria, sulfides, and phenols analyses may not be transferred using this procedure.

Appropriate soil samples (excluding sampling for VOCs) will be composited and mixed as thoroughly as possible to ensure that the sample is as representative as possible of the sample interval. The method of mixing to be used is referenced as "quartering." An equal amount of each aliquot is placed in the sample pan, and then the soil in the pan is divided into quarters. Each quarter is mixed, and then all quarters are mixed into the center of the pan. This procedure will be followed several times until the sample is adequately mixed. Subsequent to each mixing event, the pan will be decontaminated and lined with new aluminum foil in accordance with Section 2.1.2.3. Rinsate blanks will be collected to ensure field quality assurance during cleaning operations.

2.1.2.1.7 Identification of Miscellaneous (DRUMS) Containers

Miscellaneous containers, other than sample containers, shall be identified by using a sample tags or recording the necessary information on the containers. When samples are collected from

vessels or containers which can be moved (drums for example), the vessel or container should be marked with the field identification or sample station number for future identification, when necessary. The vessel or container may be labeled with an indelible marker (e.g., paint stick or spray paint). The vessel or container need not be marked if it already has a unique marking or serial number; however, these numbers shall be recorded in the bound field logbooks. In addition, it is suggested that photographs of any physical markings be taken and the necessary information recorded in the field logbook.

Occasionally, it is necessary to obtain recorder and/or instrument charts from facility owned analytical equipment, flow recorders, etc., during field investigations and inspections. Mark the charts and write the following information on these charts while they are still in the instrument or recorder :

- Starting and ending time(s) and date(s) for the chart.
- An instantaneous measurement of the media being measured by the recorder shall be taken and entered at the appropriate location on the chart along with the date and time of the measurement.
- A description of the location being monitored and other information required to interpret the data such as type of flow device, chart units, factors, etc.

After the chart has been removed, the field investigator shall indicate on the chart who the chart (or copy of the chart) was received from and enter the date and time, as well as the investigator's initials.

Documents such as technical reports, laboratory reports, etc., should be marked with the field investigator's signature, the date, the number of pages, and from whom they were received. Confidential documents should not be accepted, except in special circumstances such as process audits, hazardous waste site investigations, etc.

2.1.2.1.8 Investigation-Derived Waste

Many field investigations or closure activities will generate waste materials. These waste materials are known as investigation-derived waste (IDW). At some field investigations, these waste materials may be hazardous wastes, which must be properly disposed of in accordance with EPA regulations and the PREQB Regulations for the Control of the Hazardous Solid Wastes. EPA publication, Guide to Management of Investigation Derived Wastes, OSWER 9345.3-03FS, January 1992 is a useful guidance document for the management of IDW. Notwithstanding, precautions have been incorporated into corresponding closure and sampling protocols to avoid contamination of media, and to dispose, as hazardous wastes, all such equipment like discarded Personal Protective Equipment (PPE), visquen, supplies, etc.

All IDW will be handled according to the SESD SOP Management of IDW (SESDPROC-202-R2) found in Appendix G. All IDW will be analyzed using EPA SW-846 methodology for toxicity and will be disposed in either a Type C or Type D landfill, depending on the analysis results.

2.1.2.2 Sample Containers, Volume, and Preservation

The parameters for each analysis, the specific matrix, the EPA test method reference, the required sample container, the preservative and the sample holding time are all described in Table 2-1 below.

All samples will be analyzed in accordance with the EPA *Test Methods for the Evaluation of Solid Wastes, Third Edition - Office of Solid Waste and Emergency Response. Draft Update IVB, November 2000* (SW-846); Massachusetts Department of Environmental Protection (MDEP) *Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), Revision 1.1, May 2004* (MDEP-EPH); MDEP *Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), Revision 1.1, May 2004* (MDEP-VPH)*;* and EPA *Methods for Chemical Analysis of Water and Wastes, May 1983* (MCAWW).

TABLE 2-1
Sample Volumes, Preservation, and Holding Times

Parameter	Matrix	EPA Method	Sample	Preservative	Holding Time
VOC and/or BTEX Trace and Low Level	Liquid	SW-846 8260C	3 x 40 ml vial	Preserved with HCl $4^o \pm 2^oC$	14 days
				Un-preserved $4^o \pm 2^oC$	7 days
Naphthalene	Liquid	SW-846 8260C	3 x 40 ml vial	HCl $4^o \pm 2^oC$	14 days
RCRA Metals	Liquid	SW-846 6010C	1 x 250 ml Nalgene	HNO3 $4^o \pm 2^oC$	180 days Digest/ 180 days Analysis
Mercury	Liquid	SW-846 7470A	1 x 250 ml Nalgene	HNO3 $4^o \pm 2^oC$	28 days
SVOC	Liquid	SW-846 8270D	2 x 1 L Amber w/Teflon-lined lid	$4^o \pm 2^oC$	7 days Extraction/ 40 days Analysis
EPH	Liquid	MDEP-EPH	2 x 1 L Amber w/Teflon-lined lid	HCl $4^o \pm 2^oC$	14 days Extraction/ 40 days Analysis
VPH	Liquid	MDEP-VPH	3 x 40 ml vial	HCl $4^o \pm 2^oC$	14 days
TPH	Liquid	EPA 1664B	2 x1 L Glass bottle w/Teflon-lined lid	HCl $4^o \pm 2^oC$	7 days Extraction/ 40 days Analysis
pH	Solid	SW-846 9045D	1 x 2 oz jar w/Teflon-lined lid	$4^o \pm 2^oC$	24 Hours
RCRA Metals	Solid	SW-846 6010C	1 x 8 oz glass jar w/Teflon-lined lid	$4^o \pm 2^oC$	180 days Digest/ 180 days Analysis
Mercury	Solid	SW-846 7471A	1 x 8 oz glass jar w/Teflon-lined lid	$4^o \pm 2^oC$	28 days
SVOC	Solid	SW-846 8270D	1 x 16 oz glass jar w/ Teflon-lined lid	$4^o \pm 2^oC$	14 days Extraction/ 40 days Analysis
VOC	Solid	SW-846 8260C	1 x 4 oz glass jar w/ Teflon-lined lid and zero headspace	$4^o \pm 2^oC$	14 days
VOC Low level	Solid	SW-846 8260C	3 Encore Samplers	$NaHSO_4$ $4^o \pm 2^oC$ or frozen within 48 hours	14 days
PCBs	Solid	SW-846 8082A	1 x 16 oz glass jar w/ Teflon-lined lid	$4^o \pm 2^oC$	14 days Extraction/ 40 days analysis
EPH	Solid	MDEP-EPH	4oz. amber wide-mouth glass jar	$4^o \pm 2^oC$ or	14 days Extraction/ 40 days Analysis

Parameter	Matrix	EPA Method	Sample	Preservative	Holding Time
			w/Teflon-lined lid	Frozen at -10 °C within 48 hours of collection	Can be held for 1 year prior to analysis but must be extracted within 24 hours of thawing
VPH	Solid	MDEP-EPH	25g in 60ml vial or 15g in 40 ml vial w/Teflon-lined lid	1ml MeOH for every gram of soil/sediment added before or at time of sampling $4^{o} \pm 2^{o}C$	28 days
TPH	Solid	EPA 1664B	1 x 4oz. glass jar w/Teflon-lined lid	$4^{o} \pm 2^{o}C$	14 days Extraction/ 40 days Analysis

Notes:
For a full list of COCs and QLs, please see Worksheet #15 in Appendix A

Chemical preservatives will be used on sludge samples only if the samples are more liquid than solid and need to be analyzed as a liquid.

2.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures

The *Field Equipment Cleaning and Decontamination* (#SESD-PROC-205-R1) SOP found in the FBQSTP will be utilized during the RFI for equipment and sample container cleaning and decontamination purposes.

2.1.2.3.1 Specifications for Cleaning Materials

Specifications for standard cleaning materials referred to in this appendix are as follows:

- Soap shall be a standard brand of phosphate-free laboratory detergent such as Liquinox®. Use of other detergent must be justified and documented in the field logbooks and inspection or investigative reports.

- Solvent shall be pesticide-grade isopropanol. Use of a solvent other than pesticide-grade isopropanol for equipment cleaning purposes must be justified in the study plan. Otherwise its use must be documented in field logbooks and inspection or investigation reports.

- Tap water may be used from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.

- A 10% nitric acid solution rinse should follow the soap wash and tap water rinse for all sampling equipment used in the collection of RCRA metals.

- Analyte free water (deionized water) is tap water that has been treated by passing through a standard deionizing resin column. At a minimum, the finished water should contain no detectable heavy metals or other inorganic compounds (i.e., at or above analytical detection limits) as defined by a standard Inductively Coupled Argon Plasma Spectrophotometer (ICP) (or equivalent) scan. Analyte free water obtained by other methods is acceptable, as long as it meets the above analytical criteria.

- Organic/analyte free water is defined as tap water that has been treated with activated carbon and deionizing units. A portable system to produce organic/analyte free water under field conditions is available. At a minimum, the finished water must meet the analytical criteria of analyte free water and should contain no detectable pesticides, herbicides, or extractable organic compounds, and no volatile organic compounds above minimum detectable levels as determined by Beckton Environmental Laboratories, Inc. for a given set of analyses. Organic/analyte free water obtained by other methods is acceptable, as long as it meets the above analytical criteria.

- Other solvents may be substituted for a particular purpose if required. For example, removal of concentrated waste materials may require the use of either pesticide-grade hexane or petroleum ether. After the waste material is removed, the equipment must be subjected to the standard cleaning procedure. Because these solvents are not miscible with water, the equipment must be completely dry prior to use.

Solvents, laboratory detergent, and rinse waters used to clean equipment shall not be reused during field decontamination.

2.1.2.3.2 Handling and Containers for Cleaning Solutions

Improperly handled cleaning solutions may easily become contaminated. Storage and application containers must be constructed of the proper materials to ensure their integrity. Following are acceptable materials used for containing the specified cleaning solutions:

- Soap must be kept in clean plastic, metal, or glass containers until used. It should be poured directly from the container during use.

- Solvent must be stored in the unopened original containers until used. They may be applied using the low pressure nitrogen system fitted with a Teflon® nozzle, or using Teflon® squeeze bottles.

- Tap water may be kept in clean tanks, hand pressure sprayers, squeeze bottles, or applied directly from a hose.

- Analyte free water must be stored in clean glass, stainless steel, or plastic containers that can be closed prior to use. It can be applied from plastic squeeze bottles.

- Organic/analyte free water must be stored in clean glass, Teflon®, or stainless steel containers prior to use. It may be applied using Teflon® squeeze bottles, or with the portable system.

Note: Hand pump sprayers generally are not acceptable storage or application containers for the above materials (with the exception of tap water). This also applies to stainless steel sprayers. All hand sprayers have internal oil coated gaskets and black rubber seals that may contaminate the solutions.

2.1.2.3.3 Equipment Contaminated with Concentrated Wastes

Equipment used to collect samples of hazardous materials or toxic wastes or materials from the Site, or in-process waste streams should be field cleaned before returning from the investigation. At a minimum, this should consist of washing with soap and rinsing with tap water. More stringent procedures may be required at the discretion of the field investigators. The following decontamination procedure is recommended for all reusable stainless steel or carbon steel sampling equipment:

- Wash and scrub with soapy water containing a low phosphate detergent such as Liquinox® or Alconox®.

- Rinse with potable tap water.

- A 10% nitric acid rinse (ultra-pure grade) when sampling with stainless steel equipment or supplies for ininorganic compounds. If carbon steel utensils are used they will be rinsed with a 1% nitric acid solution to avoid the stripping of metals.

- Rinse with potable tap water.

- Isopropanol rinse (pesticide grade or better) for equipment involved in the sampling of organic compounds.

- Hexane rinse (pesticide grade or better).

- Isopropanol rinse (pesticide grade or better).

- Analyte-free water rinse. The volume of water or solution used must be at least five times the volume of the solvent or solution used in the preceding step.

- Air dry (sufficient time will be allowed for the equipment to completely dry).

- Wrap or cover the decontaminated equipment with aluminum foil for transport and handling.

2.1.2.3.4 Safety Procedures for Field Cleaning Operations

Some of the materials used to implement the cleaning procedures outlined can be harmful if used improperly. Caution should be exercised by all field investigators and all applicable safety procedures should be followed. At a minimum, the following precautions should be taken in the field during these cleaning operations:

- Safety glasses with splash shields or goggles, and latex gloves will be worn during all cleaning operations;

- Solvent rinsing operations will be conducted in the open (never in a closed room); and,

- No eating, smoking, drinking, chewing, or any hand to mouth contact should be permitted during cleaning operations.

2.1.2.3.5 Handling of Cleaned Equipment

After field cleaning, equipment should be handled only by personnel wearing clean gloves to prevent recontamination. In addition, the equipment should be moved away (preferably upwind) from the cleaning area to prevent recontamination. All equipment it should be wrapped in aluminum foil to prevent re-contamination. The area where the equipment is kept prior to re-use must be free of contaminants.

2.1.2.3.6 Field Equipment Cleaning Procedures

Sufficient clean equipment should be transported to the field so that an entire investigation can be conducted without the need for field cleaning. However, this is not possible for some specialized items such as DPT rigs and other large pieces of field equipment. In addition,

particularly during large scale investigations, it is not practical or possible to transport all of the precleaned field equipment required into the field. In these instances, sufficient pre-cleaned equipment should be transported to the field to perform at least one day's work.

2.1.2.3.7 Specifications for Decontamination Pads

Decontamination pads constructed for field cleaning of sampling and drilling equipment should meet the following minimum specifications:

- The pad should be constructed in an area known or believed to be free of surface contamination.
- The pad should not leak excessively.
- If possible, the pad should be constructed on a level, paved surface and should facilitate the removal of wastewater. This may be accomplished by either constructing the pad with one corner lower than the rest, or by creating a sump or pit in one corner or along one side. Any sump or pit should also be lined.
- Sawhorses or racks constructed to hold equipment while being cleaned should be high enough above ground to prevent equipment from being splashed.
- Water should be removed from the decontamination pad frequently.
- A temporary pad should be lined with a water impermeable material with no seams within the pad. This material should be either easily replaced (disposable) or repairable.

At the completion of site activities, the decontamination pad should be deactivated. The pit or sump should be backfilled with the appropriate material designated by the site project leader, but only after all waste/rinse water has been pumped into containers for disposal. No solvent rinsates will be placed in the pit. Solvent rinsates should be collected in separate containers for proper disposal. If the decontamination pad has leaked excessively, soil sampling may be required.

2.1.2.3.8 "Classic Parameter" Sampling Equipment

"Classic Parameters" are analyses such as oxygen demand, nutrients, certain inorganics, sulfide, flow measurements, etc. At the present time, "classic parameters" are not scheduled to be collected; however, should the need arise; the following cleaning routine must be incorporated

into the decontamination procedures. For routine operations involving classic parameter analyses, water quality sampling equipment such as Kemmerers, buckets, dissolved oxygen dunkers, dredges, etc., may be cleaned with the sample or analyte-free water between sampling locations. A brush may be used to remove deposits of material or sediment, if necessary. If analyte-free water is unavailable the samplers should be flushed at the next sampling location with the substance (water) to be sampled, before the sample is collected.

Flow measuring equipment such as weirs, staff gages, velocity meters, and other stream gauging equipment may be decontaminated with a soap wash followed by an analyte-free water rinse between measuring locations, if necessary. The volume of the water must be at least five times the volume of the soap used in the preceding step.

The previously described procedures are not to be used for cleaning field equipment to be used for the collection of samples undergoing trace organic or inorganic constituent analyses. This sampling equipment should also be stored in a different location than the equipment used for the collection of environmental samples so that it is not inadvertently used for environmental purposes.

2.1.2.3.9 Sampling Equipment used for the Collection of Trace Organic and Inorganic Compounds

The following procedures are to be used for all sampling equipment used to collect routine samples undergoing trace organic or inorganic constituent analyses:

- Wash and scrub with soapy water containing a low phosphate detergent such as Liquinox® or Alconox®.
- Rinse with potable tap water.
- A 10% nitric acid rinse (ultra-pure grade) when sampling with stainless steel equipment or supplies for ininorganic compounds. If carbon steel utensils are used they will be rinsed with a 1% nitric acid solution to avoid the stripping of metals.
- Rinse with potable tap water.
- Isopropanol rinse (pesticide grade or better) for equipment involved in the sampling of organic compounds.

- Hexane rinse (pesticide grade or better).

- Isopropanol rinse (pesticide grade or better).
- Analyte-free water rinse. The volume of water or solution used must be at least five times the volume of the solvent or solution used in the preceding step.

- Air dry (sufficient time will be allowed for the equipment to completely dry).

- Wrap or cover the decontaminated equipment with aluminum foil for transport and handling.

2.1.2.3.10 Downhole Drilling Equipment

These procedures are to be used for drilling activities involving the collection of soil samples for trace organic and inorganic constituent analyses.

Cleaning and decontamination of all equipment should occur at a designated area (decontamination pad) on the Site. The decontamination pad should meet the specifications of Section 2.1.2.3.7. Tap water (potable) brought on the site for drilling and cleaning purposes should be contained in a pre-cleaned tank. A steam cleaner and/or high pressure hot water washer capable of generating a pressure of at least 2500 PSI and producing hot water and/or steam (200^{o}F plus), with a soap compartment, should be obtained.

2.1.2.3.11 Preliminary Cleaning and Inspection

The drill rig should be clean of any contaminants that may have been transported from another hazardous waste site, to minimize the potential for cross-contamination. Further, the drill rig itself should not serve as a source of contaminants. In addition, associated drilling and decontamination equipment, well construction materials, and equipment handling procedures should meet these minimum specified criteria:

- All downhole auguring, drilling, and sampling equipment should be sandblasted before use if painted, and/or there is a buildup of rust, hard or caked matter, etc., that cannot be removed by steam cleaning (soap and high pressure hot water), or wire brushing. Sandblasting should be performed prior to arrival on site, or well away from the decontamination pad and areas to be sampled.

- Any portion of the drill rig, backhoe, etc., that is over the borehole (kelly bar or mast, backhoe buckets, drilling platform, hoist or chain pulldowns, spindles, cathead, etc.) should be steam cleaned (soap and high pressure hot water) and wire brushed (as needed) to remove all rust, soil, and other material which may have come from other hazardous waste sites before being brought on site.

- Printing and/or writing on well casing, tremie tubing, etc., should be removed before use. Emery cloth or sand paper can be used to remove the printing and/or writing. Most well material suppliers can supply materials without the printing and/or writing if specified when ordered.

- The drill rig and other equipment associated with the drilling and sampling activities should be inspected to insure that all oils, greases, hydraulic fluids, etc., have been removed, and all seals and gaskets are intact with no fluid leaks.

- PVC or plastic materials such as tremie tubes should be inspected. Items that cannot be cleaned are not acceptable and should be discarded.

2.1.2.3.12 Drill Rig Field Cleaning Procedure

Any portion of the drill rig, backhoe, etc., that is over the borehole (kelly bar or mast, backhoe buckets, drilling platform, hoist or chain pulldowns, spindles, cathead, etc.) should be steam cleaned (soap and high pressure hot water) between boreholes.

2.1.2.3.13 Field Cleaning Procedure for Drilling Equipment

The following is the standard procedure for field cleaning augers, drill stems, rods, tools, and associated equipment. This procedure does not apply to well casings, well screens, or split-spoon samplers used to obtain samples for chemical analyses, which should be cleaned as outlined in Section 2.1.2.3.9.

- Clean with tap water and soap, using a brush if necessary, to remove particulate matter and surface films. Steam cleaning (high pressure hot water with soap) may be necessary to remove matter that is difficult to remove with the brush. Drilling equipment that is steam cleaned should be placed on racks or saw horses at least two feet above the floor of the decontamination pad. Hollow-stem augers, drill rods, etc., that are hollow or have holes that transmit water or drilling fluids, should be cleaned on the inside with vigorous brushing.

- Rinse thoroughly with tap water.

- Remove from the decontamination pad and cover with clean, unused plastic. If stored overnight, the plastic should be secured to ensure that it stays in place. When there is concern for low level contaminants it may be necessary to clean this equipment between borehole drilling and/or monitoring well installation using the procedure outlined in Section 2.1.2.3.9.

2.1.2.3.14 Emergency Disposable Sample Container Cleaning

New one-pint or one-quart mason jars may be used to collect samples for analyses of organic compounds and metals in waste and soil samples during an emergency. These containers would also be acceptable on an emergency basis for the collection of water samples for extractable organic compounds and metals analyses. These jars cannot be used for the collection of water samples for VOC analyses.

The rubber sealing ring should not be in contact with the jar and aluminum foil should be used, if possible, between the jar and the sealing ring. If possible, the jar and aluminum foil should be rinsed with pesticide-grade isopropanol and allowed to air dry before use. Several empty bottles and lids should be submitted to the laboratory as blanks for quality control purposes.

2.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures

Instruments used to collect any field measurements must be calibrated according to manufacturer's specifications at the start of each day, and may also be calibrated during the day if field personnel consider it necessary. Calibrations will be recorded in the field logbook on a daily basis.

One piece of field equipment that will be utilized at the CORCO Site includes MIP technology. MIP technology utilizes real time analysis of vapors generated by advancing a heated probe at the end of a geoprobe drilling rod. The heat volatizes organic compounds which pass through a permeable membrane into a carrier gas for analysis using a PID located on a support vehicle adjacent to the geoprobe rig. The PID has a detection limit of 1 ppm for total VOCs. This detection limit is sufficient for source delineation and high mass migration given the levels expected for screening purposes. Further detail on this technology is provided in the attached SOP developed by Geoprobe Systems (Appendix G). The MIP will be advanced to a depth of 10

feet or groundwater whichever occurs first. A surveyor or GPS will be used to locate the sample points. Additional MIP locations may be added as needed to delineate areas of concern.

A field hand held XRF device will be used to field screen for metals. Further detail on this instrument is provided in the attached SOP in Appendix G.

2.1.2.5 Field Documentation Procedures

2.1.2.5.1 Field Records

Each project should have a dedicated logbook. The project leader's name, the sample team leader's name (if appropriate), the project name and location, and the project number should be entered on the inside of the front cover of the logbook. It is recommended that each page in the logbook be numbered and dated. The entries should be legible and contain accurate and inclusive documentation of an individual's project activities. At the end of all entries for each day, or at the end of a particular event, if appropriate, the investigator should draw a diagonal line and initial indicating the conclusion of the entry. Since field records are the basis for later written reports, language should be objective, factual, and free of personal feelings or other terminology which might prove inappropriate. Once completed, these field logbooks become accountable documents and must be maintained as part of the official project files. All aspects of sample collection and handling, as well as visual observations, shall be documented in the field logbooks. The following is a list of information that should be included in the logbook:

- Sample collection equipment (where appropriate);
- Field analytical equipment, and equipment utilized to make physical measurements shall be identified;
- Calculations, results, and calibration data for field sampling, field analytical, and field physical measurement equipment;
- Property numbers of any sampling equipment used, if available;
- Sampling station identification;
- Time of sample collection;
- Description of the sample location;
- Description of the sample;
- Who collected the sample;
- How the sample was collected;
- Diagrams of processes;

- Maps/sketches of sampling locations; and,
- Weather conditions that may affect the sample (e.g., rain, extreme heat or cold, wind, etc.).

2.1.2.5.2 Photographs and Digital Still Images

When photographs or digital images are taken, a record of each exposure or image shall be kept in a bound field logbook. The following information shall be recorded in the logbook:

- An accurate description of what the photograph or image shows, including;
- Facility name or site and the specific project name and project number;
- The date and time that the photograph or image was taken; and
- The name of the individual who took the photograph or digital image.

When photographs are used in technical reports or placed in the official files, the film shall be developed with the negatives supplied uncut. The identifying information that was recorded in the field logbook shall be entered on the back of the prints.

When digital images are used in technical reports or placed in the official files, the disk with the original, unaltered file of the images or a printed copy of the unaltered images shall be placed in the official files as well. If printed copies of the images are used, each image shall be identified using the information that was recorded in the field logbook.

2.2 ANALYTICAL TASKS

The parameters being measured and analytical methods to be used are presented in Table 2-2. All samples will be analyzed as definitive data (analytical data that are suitable for final decision-making), in accordance with EPA SW-846.

TABLE 2-2
Analytical Methods

Parameter	Matrix	EPA Method
VOC and/or BTEX	Liquid	SW-846 8260C
Naphthalene	Liquid	SW-846 8260C
RCRA Metals	Liquid	SW-846 6010C

Parameter	Matrix	EPA Method
Mercury	Liquid	SW-846 7470A
SVOC	Liquid	SW-846 8270D
EPH	Liquid	MADEP-EPH
VPH	Liquid	MADEP-VPH
TPH	Liquid	USEPA 1664B
pH	Solid	Standard Methods 4500 H^+ B
RCRA Metals	Solid	SW-846 6010C
Mercury	Solid	SW-846 7471A
SVOC	Solid	SW-846 8270D
VOC	Solid	SW-846 8260C
PCBs	Solid	SW-846 8082A
Total Solids	Solid	Standard Methods 2540 B
EPH	Solid	MADEP-EPH
VPH	Solid	MADEP-VPH
TPH	Solid	USEPA 1664B

Beckton Environmental Laboratories, Inc. will prepare data package deliverables so data quality can be assessed. For this project, it is anticipated that CLP equivalent deliverables (as defined in Section 2.5.2) will be provided for all analytical data.

Throughout the RFI, the most current revision or update of SW-846 should be utilized when applicable.

2.2.1 Analytical SOPs

The analytical laboratory SOPs for the methods listed in Table 2-2 are presented in Appendix C of this QAPP.

2.2.2 Analytical Instrument Calibration Procedures

Calibration is required to demonstrate that the instruments used to perform quantitative chemical analysis are operating properly. Correct operation is important in meeting sensitivity requirements and in establishing detection limits. There are two types of calibration: (1) initial calibration, which is performed prior to instrument usage (i.e., standard curves); and (2) continuing calibration verification, which is performed at prescribed intervals.

Recognized procedures (e.g., EPA, American Society for Testing and Materials (ASTM), manufacturer's instructions) will be used when available. The EPA and/or SW-846 calibration procedures specified in the organic and inorganic SOPs, other EPA-approved methods, and manufacturer's instructions will be implemented when available. Written calibration procedures will include the reference materials to be used, the calibration technique, the acceptable performance limits, and the frequency.

The calibration procedures and frequencies for the analysis of soil and groundwater samples for the laboratory are specified in the laboratory method SOPs in Appendix C.

2.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures

As part of their QA/QC program, routine preventive maintenance programs are conducted by Beckton Environmental Laboratories, Inc. to minimize the occurrence of instrument and equipment failure and other system malfunctions. Routine scheduled maintenance and repair is performed or coordinated with the vendor for the repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications or as appropriate for the instrument. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratories' instrument service logbooks for each of their instruments. Each laboratory unit will maintain the following:

- Instrument/equipment inventory list;
- Instrument/equipment major spare parts list or inventory;
- Appropriate external service agreement documents; and,
- Instrument-specific preventive maintenance logbook or file for each functional unit.

The test instruments will follow the preventive maintenance procedures listed in the SOPs for the analytical methods (Appendix C). All maintenance activities will be documented in the log books to provide a history of maintenance records, including the following items as a minimum:

- Name and serial number of the item or equipment;
- Details of maintenance performed; and,

- Analyst's initials and the date maintenance was performed by the analyst or by a contracted service representative.

2.2.4 Analytical Supply Inspection and Acceptance Procedures

As part of their QA/QC program, Beckton Environmental Laboratories, Inc. will document the procedures and activities that will be performed to ensure that all supplies used in analytical work will be available when needed and will be free of target analytes/COCs and interferences. Each laboratory unit will maintain records of the following:

- Supplies used in the performance of analytical work;
- Names of vendors for supplies and reagents;
- Specifications for all supplies and reagents that could affect data quality (level of contamination, pesticide versus reagent-grade) and procedures that will be used to ensure supply cleanliness and reagent purity (reagent lot numbers);
- Procedures for measuring supply cleanliness; and,
- Corrective action procedures for preventing the use of unacceptable supplies.

The individuals responsible for checking supplies and implementing corrective action will be identified in the LQAP in Appendix B.

2.3 SAMPLE COLLECTION DOCUMENTATION, HANDLING, TRACKING, AND CUSTODY PROCEDURES

According to the Region 4 FBQSTP, sample identification, chain-of-custody records, receipt for sample forms, and field records (with the exception of surveying notes) should be recorded with waterproof, non-erasable ink. If errors are made in any of these documents, corrections should be made by crossing a single line through the error and entering the correct information. All corrections should be initialed and dated. If possible, all corrections should be made by the individual making the error.

If information is entered onto sample tags, logbooks, or sample containers using stick-on labels, the labels should not be capable of being removed without leaving obvious indications of the attempt. Labels should never be placed over previously recorded information. Corrections to information recorded on stick-on labels should be made as stated above.

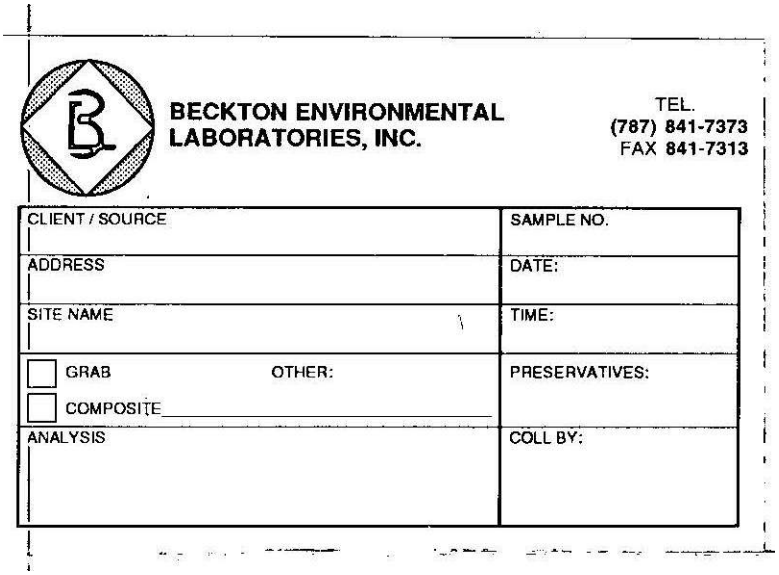
2.3.1 Sample Collection Documentation

Each sample collected will be identified by a sample label that will be attached to the sample container. The following information will be included on the sample tag:

- Project name;
- Sample field identification or sample station number;
- Date and time of sample collection;
- Designation of the sample as a grab or composite;
- Initial of the sampler;
- Designation of whether the sample is preserved or unpreserved, and type of preservative;
- General types of analyses to be conducted; and
- Any relevant comments such as detectable or identifiable odor, color, or known toxic properties.

Figure 2-1 shows an example of a sample container label.

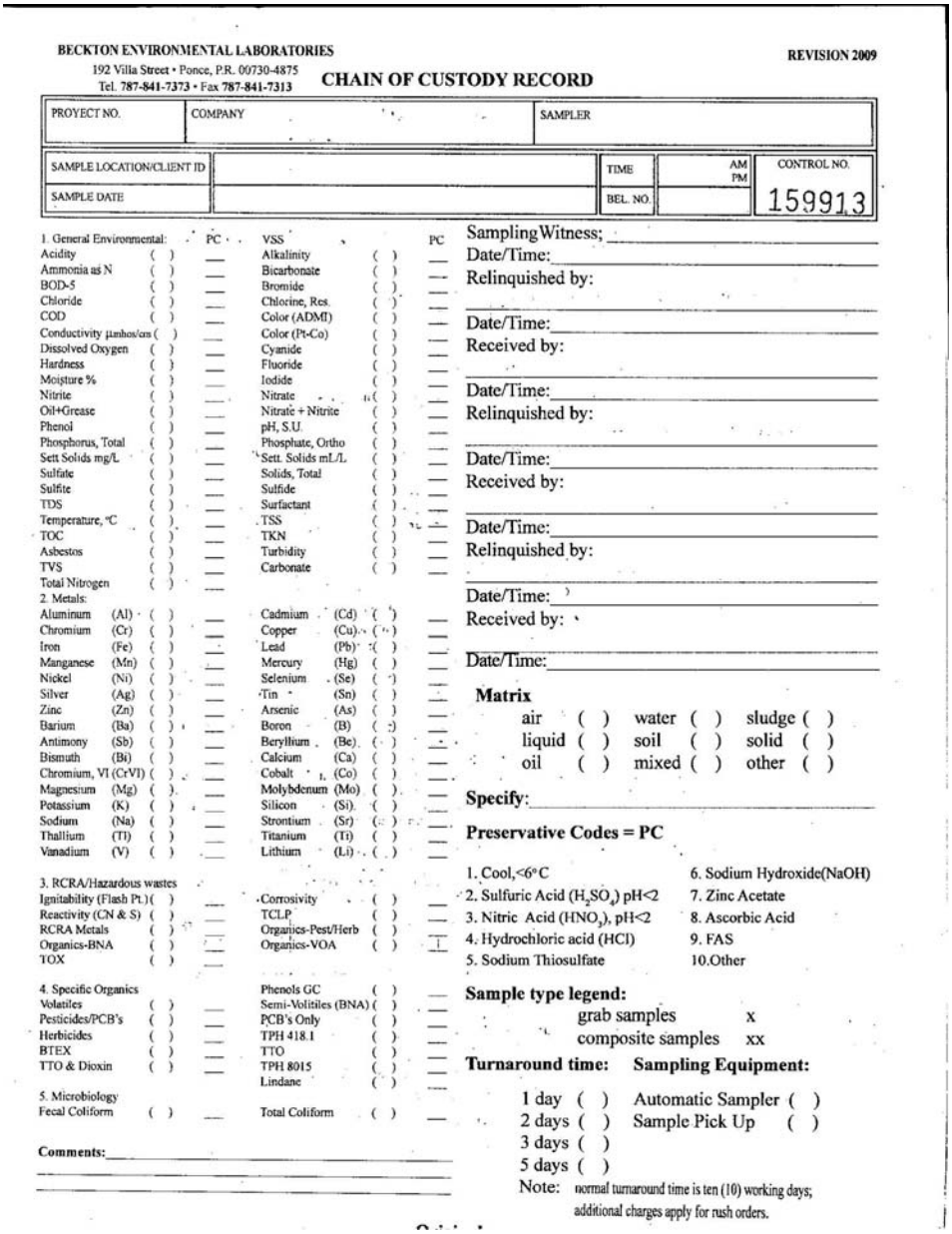
FIGURE 2-1
EXAMPLE SAMPLE CONTAINER LABEL



Once the sample label is placed on the container, it will be completely covered with clear packaging tape to minimize water damage during transit.

The identical information will be recorded on a chain-of-custody to be provided by Beckton. An example is found in Figure 2-2.

FIGURE 2-2
EXAMPLE CHAIN-OF-CUSTODY FORM



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REVISION 2009

CHAIN OF CUSTODY RECORD

PROYECT NO.	COMPANY	SAMPLER	
SAMPLE LOCATION/CLIENT ID		TIME / AM PM	CONTROL NO.
SAMPLE DATE		BEL. NO.	159913

1. General Environmental:	PC	VSS	PC
Acidity ( )		Alkalinity ( )	
Ammonia as N ( )		Bicarbonate ( )	
BOD-5 ( )		Bromide ( )	
Chloride ( )		Chlorine, Res. ( )	
COD ( )		Color (ADMI) ( )	
Conductivity µmhos/cm ( )		Color (Pt-Co) ( )	
Dissolved Oxygen ( )		Cyanide ( )	
Hardness ( )		Fluoride ( )	
Moisture % ( )		Iodide ( )	
Nitrite ( )		Nitrate ( )	
Oil+Grease ( )		Nitrate + Nitrite ( )	
Phenol ( )		pH, S.U. ( )	
Phosphorus, Total ( )		Phosphate, Ortho ( )	
Sett Solids mg/L ( )		Sett. Solids mL/L ( )	
Sulfate ( )		Solids, Total ( )	
Sulfite ( )		Sulfide ( )	
TDS ( )		Surfactant ( )	
Temperature, °C ( )		TSS ( )	
TOC ( )		TKN ( )	
Asbestos ( )		Turbidity ( )	
TVS ( )		Carbonate ( )	
Total Nitrogen ( )			
2. Metals:			
Aluminum (Al) ( )		Cadmium (Cd) ( )	
Chromium (Cr) ( )		Copper (Cu) ( )	
Iron (Fe) ( )		Lead (Pb) ( )	
Manganese (Mn) ( )		Mercury (Hg) ( )	
Nickel (Ni) ( )		Selenium (Se) ( )	
Silver (Ag) ( )		Tin (Sn) ( )	
Zinc (Zn) ( )		Arsenic (As) ( )	
Barium (Ba) ( )		Boron (B) ( )	
Antimony (Sb) ( )		Beryllium (Be) ( )	
Bismuth (Bi) ( )		Calcium (Ca) ( )	
Chromium, VI (CrVI) ( )		Cobalt (Co) ( )	
Magnesium (Mg) ( )		Molybdenum (Mo) ( )	
Potassium (K) ( )		Silicon (Si) ( )	
Sodium (Na) ( )		Strontium (Sr) ( )	
Thallium (Tl) ( )		Titanium (Ti) ( )	
Vanadium (V) ( )		Lithium (Li) ( )	
3. RCRA/Hazardous wastes			
Ignitability (Flash Pt.) ( )		Corrosivity ( )	
Reactivity (CN & S) ( )		TCLP ( )	
RCRA Metals ( )		Organics-Pest/Herb ( )	
Organics-BNA ( )		Organics-VOA ( )	
TOX ( )			
4. Specific Organics		Phenols GC ( )	
Volatiles ( )		Semi-Volitiles (BNA) ( )	
Pesticides/PCB's ( )		PCB's Only ( )	
Herbicides ( )		TPH 418.1 ( )	
BTEX ( )		TTO ( )	
TTO & Dioxin ( )		TPH 8015 ( )	
		Lindane ( )	
5. Microbiology			
Fecal Coliform ( )		Total Coliform ( )	

Comments:

Sampling Witness;
Date/Time:
Relinquished by:
Date/Time:
Received by:
Date/Time:
Relinquished by:
Date/Time:
Received by:
Date/Time:
Relinquished by:
Date/Time:
Received by:
Date/Time:

Matrix

air ( ) water ( ) sludge ( )
liquid ( ) soil ( ) solid ( )
oil ( ) mixed ( ) other ( )

Specify:

Preservative Codes = PC

1. Cool,<6°C
2. Sulfuric Acid (H_2SO_4) pH<2
3. Nitric Acid (HNO_3), pH<2
4. Hydrochloric acid (HCl)
5. Sodium Thiosulfate
6. Sodium Hydroxide(NaOH)
7. Zinc Acetate
8. Ascorbic Acid
9. FAS
10.Other

Sample type legend:

grab samples x
composite samples xx

Turnaround time:

1 day ( )
2 days ( )
3 days ( )
5 days ( )

Note: normal turnaround time is ten (10) working days; additional charges apply for rush orders.

Sampling Equipment:

Automatic Sampler ( )
Sample Pick Up ( )

The sample numbering scheme is discussed in Section 2.3.2.

2.3.2 Sample Handling and Tracking System

Proper sample tracking systems support the chain-of-custody procedures, which in turn help to ensure sample authenticity and data defensibility.

2.3.2.1 Sample Handling

As stated in Section 2.3.1, upon collection, each sample will be identified by a sample label that will be attached to the sample container. The identical information will be recorded in a field logbook and on the daily chain-of-custody form. The form will accompany the samples to the laboratory, while a copy will be maintained on-site in the field office, a copy will be kept on file by the QAO, and a fourth copy will be kept on file at CORCO offices.

The method of sample identification used depends on the type of sample collected. In-situ field samples are those collected for specific field analysis or measurement where the data are recorded directly in bound field logbooks or on the chain-of-custody record, with identifying information, while in the custody of the sampling team. Examples of such in-situ field measurements and analyses include pH, temperature, dissolved oxygen and conductivity. Samples other than those collected for in-situ analysis are identified by using a standard sample label (Figure 2-1) which is attached to the sample container. In all cases, the sample label will be attached to the sample and secured with clear packaging tape. The following information shall be included on the sample label using waterproof, non-erasable ink:

- Project number;
- Field identification;
- Date and time of sample collection;
- Designation of the sample as a grab or composite;
- A very brief description of the sampling location;
- The signature of either the sampler(s) or the designated sampling team leader and the field
- Sample custodian (if appropriate);

- Whether the sample is preserved or unpreserved;
- The general types of analyses to be performed (checked on front of tag); and
- Relevant comments (such as readily detectable or identifiable odor, color, or known toxic properties).

If a sample is split with a facility, state regulatory agency, or other party representative, the recipient should be provided (if enough sample is available) with an equal weight or volume of sample.

2.3.2.1.1 Sample Number Scheme

The method of sample identification used depends on the type of sample collected. In-situ field samples are those collected for specific field analysis or measurement where the data are recorded directly in bound field logbooks or on the chain-of-custody record, with identifying information, while in the custody of the sampling team. Examples of such in-situ field measurements and analyses include pH, temperature, dissolved oxygen and conductivity. Samples other than those collected for in-situ analysis are identified by using a standard sample label (Figure 2-1) which is attached to the sample container.

If a sample is split with a facility, state regulatory agency, or other party representative, the recipient should be provided (if enough sample is available) with an equal weight or volume of sample.

The sample number scheme will vary slightly for solids and liquids in order to accommodate specific sample information for each media.

Each sample will be numbered by using a unique identification (ID). Each sample will be identified by the AOC from which it was collected. The next element of the ID will be the matrix identifier, followed by a three-digit number to indicate the order in which the sample was collected in that particular AOC. A sample number of 001 will indicate that the sample collected was the first sample collected in that AOC; a sample number of 056 will indicate that the sample

collected was the fifty-sixth sample collected in that AOC, etc. This will be followed by the sample depth (in feet). Table 2-3 lists the codes for the different AOCs and matrices.

TABLE 2-3
Sample Identification Codes

Area/ Equipment Codes	
Code	**Equipment Area**
MSRU	Main Site – Former Refinery Units
MSRDT	Main Site – Run Down Tanks (Inactive Storage Tanks)
MSLF	Main Site – Leaded Fuel Handling Area
MSOS	Main Site – Open Storage Areas
API	Main Site – API Oil Water Separator
DAF	Main Site – Dissolved Air Flotation Unit
WL	Western Lagoons
CWW	Western Lagoons-Cooling Water West Lagoon
CWE	Western Lagoons-Cooling Water East Lagoon
AL	Western Lagoons-Aeration Lagoon
JL	Western Lagoons-Jakes Lagoon
OL	Western Lagoons-Oxidation Lagoon
IC	Western Lagoons – Influent Channel
EC	Western Lagoons – Effluent Channel
FP	Flores Peninsula
OCI	Oxochem/Caribe Isoprene
EL	Eastern Lagoon
MSAP	Main Site Pipeline
TP	Tallaboa Pipeline
CICT	Caribe Isoprene Corporation Tanks
Matrix Codes	
Code	**Matrix**
S	Soil
C	Soil Field Duplicate
D	Sediment
Y	Sediment Field Duplicate
FB	Field Blank
RB	Rinsate Blank
TB	Trip Blank

For example, sample ID APIS0620-1 indicates that the sample was collected at the API Oil Water Separator at the main site, sixty-second in sequence, and from a depth of 0-1 foot below ground surface (bgs). The date of sample collection will be recorded on the sample label and the chain-of-custody; it will then be concatenated into the full sample ID in the Access© database utilized by NewFields.

A stake labeled with the sample ID will be placed into the ground immediately following sample collection so that the exact location can be surveyed. This location will be recorded into the field logbook and added to the NewFields Access© database so that the corresponding sample will be linked to its proper location.

Groundwater samples are not included in this scheme because the ID of all monitoring and piezometer wells has been previously designated.

2.3.2.1.2 QC Sample Identification Numbers

Most QC sample identification numbers are similar to the investigative sample identifiers, except for either a different matrix code or an identification number that incorporates the sample date. QC samples that require different ID numbers are field duplicates, field blanks, and rinsate blanks. Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples do not require a separate ID. Table 2-3 in the previous section lists the matrix codes for the QC samples.

For duplicate samples, the ID number remains the same as the primary sample number, except the matrix code is changed. The matrix code for soil is changed from "S" to "C"; and for sediment the "D" is changed to a "Y". This way, the field duplicates are submitted "blind" to the laboratory.

The sample identification numbers for field blanks and rinsate blanks combine the AOC, the blank type, and the date the sample is collected. Sample ID MSRUEB07142012 indicates that an equipment blank was collected from equipment used at the Main Site Former Refinery Units on July 14, 2012.

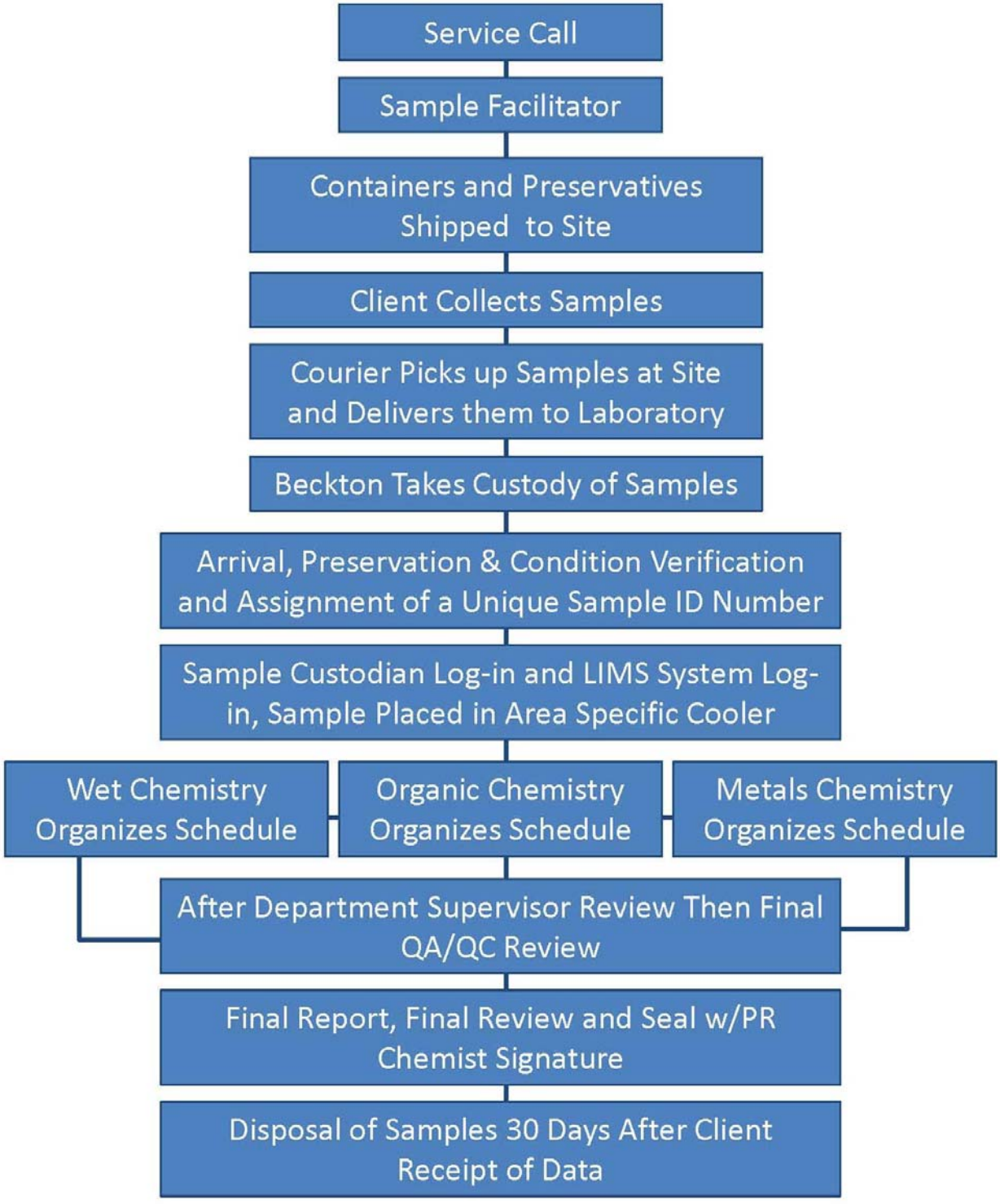
Groundwater duplicate samples will be assigned unique ID. A duplicate of MW-1 may be assigned an ID of MW-14 (MW-14 does not exist on the CORCO Site) and a duplicate of PD-03 may be assigned an ID of PD-40 (which also does not exist on the CORCO Site). These unique IDs will be recorded in the field logbook along with the ID of the parent samples. These unique IDs will allow the duplicate sample to remain "blind" to the laboratory.

Chain-of-custody procedures are comprised of the following elements: 1) maintaining custody of samples, and 2) documentation of the chain-of-custody. To document chain-of-custody, an accurate record must be maintained to trace the possession of each sample, or other evidence, from the moment of collection to its introduction into evidence.

2.3.2.1.3 Laboratory Sample Tracking

The laboratory sample tracking procedures can be found in Appendix B. Figure 2-3 provides a picture of the flow of samples from the time of collection to laboratory delivery to final sample disposal.

FIGURE 2-3
SAMPLE FLOW



2.3.2.1.4 Laboratory Sample Storage

The laboratory sample storage procedures can be found in Appendix B.

2.3.2.2 Sample Delivery

Samples will be transported to the Beckton at the end of each day by the laboratory's own courier service. If for some reason the courier service is not available, the samples will be transported to the laboratory by the on-site field manager. All personnel must be aware that certain samples are potentially hazardous materials and as such are regulated by the U.S. Department of Transportation. These regulations are contained in Title 49, CFR, Parts 110-119. Although the samples will not be shipped by air transport, all requirements in the SESD SOP *Shipping Environmental and Waste Samples* (#SESDPROC-209-R1), found in Appendix G, will be adhered to.

All samples must be packed so as to avoid breakage and prevent cross-contamination according to the following procedures.

1. Select a cooler in good condition. Seal the drain plug on the inside and outside of the cooler with tape to prevent leakage.
2. Ensure that cooler is clean and strong enough for shipping purposes.
3. In order to prevent breakage while packaging samples, *either*:

   — Wrap samples in bubble wrap or other suitable packing material, and seal around the containers with tape. Protective wrap is not required for plastic containers, but take care when packing the coolers so that the containers do not directly touch each other.

   or

   – Place 2 to 4 inches of inert packing material on the bottom of the cooler. Place the bagged containers inside the cooler so the bottles do not touch each other. Place cooling material (e.g., bagged ice, blue ice) around and between the samples. Completely fill any remaining space with inert packing material such as vermiculite or cellulose insulation.

4. Include a temperature blank or strip in each sample cooler.

5. Place a trip blank in each cooler containing VOCs. Every effort should be made to ensure that all of the VOCs are packaged together into the same cooler.

6. Place double-bagged ice inside the cooler to chill the samples to 4°C (± 2°C).

7. Place a chain-of-custody record describing the contents of each cooler in a plastic bag and seal it to the inside of the lid of each cooler.

8. Place a sheet of paper with the destination of the samples inside the cooler.

9. Seal the cooler with tape and custody seals so that the cooler cannot be opened without breaking the seal.

Upon receipt at the laboratory, Beckton will divide the samples into Sample Delivery Groups (SDGs). An SDG is defined as a group of 20 or fewer samples within a project. Proficiency testing samples and other QC samples (e.g. equipment blanks, VOC trip blanks) are counted as field samples in the 20-sample SDG total.

2.3.3 Sample Custody

A sample is in custody if:

- It is in the actual possession of an investigator;
- It is in the view of an investigator, after being in their physical possession;
- It was in the physical possession of an investigator and then they secured it to prevent tampering; and/or
- It is placed in a designated secure area.

2.3.3.1 Documentation of Chain-of-Custody

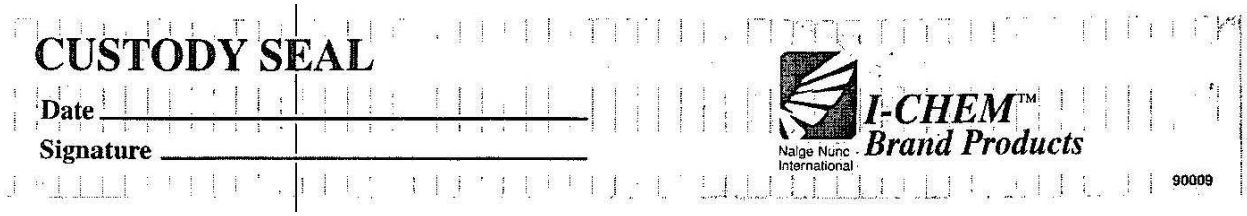
2.3.3.1.1 Sample Label

A sample label (Figure 2-1) should be completed for each sample using waterproof, non-erasable ink.

2.3.3.1.2 Sample Seals

Samples should be sealed as soon as possible following collection using the EPA custody seal shown in Figure 2-4. The sample custodian should write the date and their initials on the seal. The use of custody seals may be waived if field investigators keep the samples in their custody from the time of collection until the samples are delivered to Beckton Environmental Laboratories, Inc.

FIGURE 2-4
EXAMPLE CUSTODY SEAL



2.3.3.1.3 Chain-of-Custody Record

The field chain-of-custody record (Figure 2-3) is used to record the custody of all samples collected and maintained by investigators. All sample sets shall be accompanied by a chain-of-custody record. This chain-of-custody record documents transfer of custody of samples from the sample custodian to another person, to the laboratory, or other organizational elements. To simplify the chain-of-custody record and eliminate potential litigation problems, as few people as possible should have custody of the samples during the investigation. This form shall not be used to document the collection of split samples where there is a legal requirement to provide a receipt for samples. The chain-of-custody record also serves as a sample logging mechanism for the laboratory sample custodian. A separate chain-of-custody record should be used for each final destination of the samples collected during the investigation.

All information must be supplied in the indicated spaces (Figure 2-3) to complete the field chain-of-custody record.

- All samplers and sampling team leaders (if applicable) must sign in the designated signature block.
- One sample should be entered on each line and not be split among multiple lines.

- If multiple sampling teams are collecting samples, the sampling team leader's name should be indicated on the label.

- If the individual serving as the field sample custodian is different from the individual serving as the project leader, the field sample custodian's name and the title of the sample custodian (e.g., Jane Doe, Sample Custodian) should be recorded in the "Remarks/Air bill" block at the top of the chain-of-custody record. The “Remarks/Air bill” block may also be used to record Air bill numbers or registered or certified mail serial numbers.

- The total number of sample containers for each sample must be listed in the "Total Containers" column. The number of individual containers for each analysis must also be listed in the respective column. Required analyses should be circled or entered in the appropriate location as indicated on the chain-of-custody record.

- The sample custodian and subsequent transferee(s) should document the transfer of the samples listed on the chain-of-custody record. The person who originally relinquishes custody should be the sample custodian. Both the person relinquishing the samples and the person receiving them must sign the form. The date and time that this occurs should be documented in the proper space on the chain-of-custody record.

- Usually, the last person receiving the samples or evidence should be the laboratory sample custodian or their designee(s).

The chain-of-custody record is a serialized document. Once the record is completed, it becomes an accountable document and must be maintained in the project file. The suitability of any other form for chain-of-custody should be evaluated based upon its inclusion of all of the above information in a legible format.

If chain-of-custody is required for documents received during investigations, the documents should be placed in large envelopes, and the contents should be noted on the envelope. The envelope shall be sealed and an EPA custody seal placed on the envelope such that it cannot be opened without breaking the seal. A chain-of-custody record shall be maintained for the envelope. Any time the EPA seal is broken, that fact shall be noted on the chain-of-custody record and a new seal affixed. The information on the seal should include the sample custodian's initials and the date.

EPA custody seals can be used to maintain custody of other items when necessary by using similar procedures as those previously outlined in this section.

Samples should not be accepted from other sources unless the sample collection procedures used are known to be acceptable, can be documented, and the sample chain-of-custody can be established. If such samples are accepted, a standard sample tag containing all relevant information and the chain-of-custody record shall be completed for each set of samples.

2.3.3.1.4 Transfer of Custody with Shipment

Samples shall be properly packaged for shipment in accordance with the procedures outlined in Section 2.3.2.2 of this QAPP.

All samples must be accompanied by the chain-of-custody record. The original record will be placed in a plastic bag inside the secured shipping container if samples are shipped. When shipping samples via common carrier, the "Relinquished By" box should be filled in; however, the "Received By" box should be left blank. The laboratory sample custodian is responsible for receiving custody of the samples and will fill in the "Received By" section of the chain-of-custody record. One copy of the record will be retained by the project leader in the field office and one copy will be forward to the QAO. The original chain-of-custody record will be transmitted to the QAO with the data deliverables. This copy will become a part of the project file. Finally, an additional copy will be kept on file at CORCO offices.

At no time will samples be sent to the laboratory by mail or express air courier.

2.3.3.1.5 Receipt for Samples Form

Section 3007 of the RCRA of 1976 requires that a "receipt" for all facility samples collected during inspections and investigations be given to the owner/operator of each facility before the field investigator departs the premises. The law does not require that homeowners or other off-site property owners be given this form.

The Receipt for Samples form (Figure 2-5) is to be used to satisfy the receipt for samples provisions of RCRA. The form also documents that split samples were offered and either "Received" or "Declined" by the owner/operator of the facility or site being investigated. All information must be supplied in the indicated spaces to complete the Receipt for Samples form.

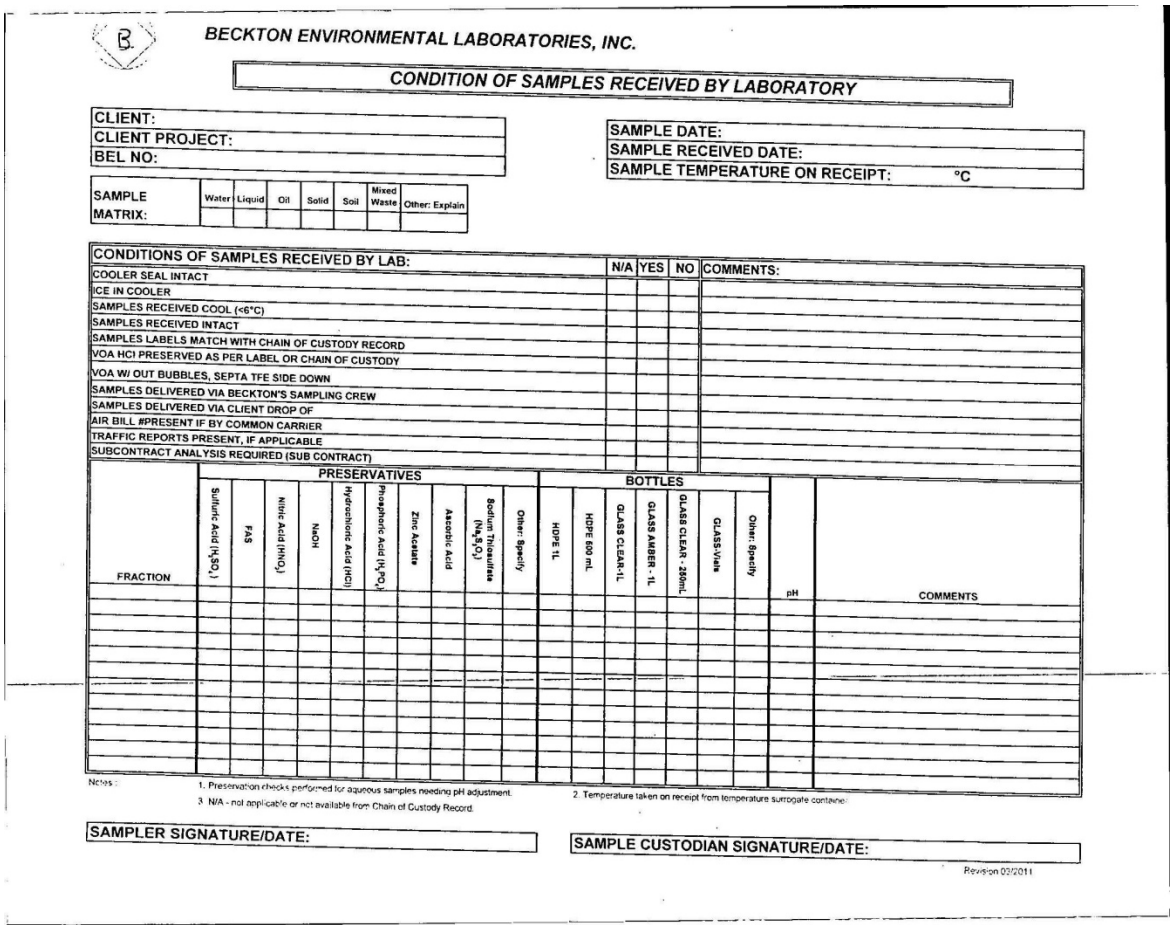
- The sampler(s) must sign the form in the indicated location. If multiple sample teams are collecting samples, the sample team leader's name should be indicated in the "EPA Sample Tag No./Remarks" column.

- Each sample collected from the facility or site must be documented in the sample record portion of the form. The sample station number, date and time of sample collection, composite or grab sample designation, whether or not split samples were collected (yes or no should be entered under the split sample column), the tag numbers of samples collected which will be removed from the site, a brief description of each sampling location, and the total number of sample containers for each sample must be entered.

- The bottom of the form is used to document the site operator's acceptance or rejection of split samples. The project leader must sign and complete the information in the "Split Samples Transferred By" section (date and time must be entered). If split samples were not collected, the project leader should initial and place a single line through "Split Samples Transferred By" in this section. The operator of the site must indicate whether split samples were received or declined and sign the form. The operator must give their title, telephone number, and the date and time they signed the form. If the operator refuses to sign the form, the sampler(s) should note this fact in the operator's signature block and initial this entry.

The Receipt for Samples form is serialized and becomes an accountable document after it is completed. A copy of the form is to be given to the facility or site owner/operator. The original form must be maintained in the project files.

FIGURE 2-5
RECEIPT OF SAMPLES FORM



BECKTON ENVIRONMENTAL LABORATORIES, INC.

CONDITION OF SAMPLES RECEIVED BY LABORATORY

CLIENT:
CLIENT PROJECT:
BEL NO:

SAMPLE DATE:
SAMPLE RECEIVED DATE:
SAMPLE TEMPERATURE ON RECEIPT: °C

SAMPLE MATRIX:	Water	Liquid	Oil	Solid	Soil	Mixed Waste	Other: Explain

CONDITIONS OF SAMPLES RECEIVED BY LAB:	N/A	YES	NO	COMMENTS:
COOLER SEAL INTACT				
ICE IN COOLER				
SAMPLES RECEIVED COOL (<6°C)				
SAMPLES RECEIVED INTACT				
SAMPLES LABELS MATCH WITH CHAIN OF CUSTODY RECORD				
VOA HCl PRESERVED AS PER LABEL OR CHAIN OF CUSTODY				
VOA W/ OUT BUBBLES, SEPTA TFE SIDE DOWN				
SAMPLES DELIVERED VIA BECKTON'S SAMPLING CREW				
SAMPLES DELIVERED VIA CLIENT DROP OF				
AIR BILL #PRESENT IF BY COMMON CARRIER				
TRAFFIC REPORTS PRESENT, IF APPLICABLE				
SUBCONTRACT ANALYSIS REQUIRED (SUB CONTRACT)				

	PRESERVATIVES										BOTTLES								
FRACTION	Sulfuric Acid (H_2SO_4)	FAS	Nitric Acid (HNO_3)	NaOH	Hydrochloric Acid (HCl)	Phosphoric Acid (H_3PO_4)	Zinc Acetate	Ascorbic Acid	Sodium Thiosulfate ($Na_2S_2O_3$)	Other: Specify	HDPE 1L	HDPE 500 mL	GLASS CLEAR-1L	GLASS AMBER - 1L	GLASS CLEAR - 250mL	GLASS Vials	Other: Specify	pH	COMMENTS

Notes:
1. Preservation checks performed for aqueous samples needing pH adjustment.
2. Temperature taken on receipt from temperature surrogate container.
3. N/A - not applicable or not available from Chain of Custody Record.

SAMPLER SIGNATURE/DATE:

SAMPLE CUSTODIAN SIGNATURE/DATE:

Revision 02/2011

2.4 QUALITY CONTROL SAMPLES

Quality control is the set of activities that are performed for the purposes of monitoring, measuring, and controlling the performance of a measurement process. QC samples provide measurable data quality indicators used to evaluate the different components of the measurement system, including sampling and analysis.

A complete list of quality control samples, their respective acceptance limits, required analysis frequency, and corrective actions can be found on Worksheet #28 in Appendix A.

2.4.1 Sampling Quality Control Samples

The primary measurements for both field and laboratory QA/QC are derived from field blanks, equipment rinsate blanks, trip blanks, field duplicates, and MS/MSD samples collected in the field. Evaluation of QA objectives for these samples is described in Section 4.2.2 of this document. Table 2-4 summarizes QC samples that are frequently incorporated into chemical data collection. Identification numbers assigned to QC samples are described in Section 2.3.2.1.2, and the following sections briefly describe the types of QC samples that will be used for the RFI.

Table 2-4
Recommended Types and Frequency of Sampling QC Samples for Chemical Data Collection

Quality Control Sample	Data Quality Indicator	Recommended Frequency
Field Blanks	Contamination (Accuracy/Bias)	Minimum 1 per day per sampling team
Rinsate Blanks	Contamination (Accuracy/Bias)	Minimum 5% per analytical group per matrix per sampling procedure per sampling team
Trip Blanks	Contamination (Accuracy/Bias)	Minimum 1 per shipment cooler per analytical group per concentration level
Field Duplicates	Precision	Minimum 10% per analytical group per matrix per sampling procedure per sampling team
MS/MSD Samples	Accuracy/Bias	Minimum 5% per analytical group per matrix per sampling procedure per sampling team

2.4.1.1 Field Blanks

Field blanks are organic-free water taken to the field in sealed containers and then poured into the appropriate sample containers at pre-designated locations. This is done to determine if any contaminants present in the area may have an effect on the sample integrity. Field blanks should not be collected in dusty environments and/or from areas where contamination is present in the atmosphere and originating from a source other than the source being sampled. Field blanks will be collected once per day per sampling team and analyzed for the same parameters as all of the samples collected that day by that sampling team.

2.4.1.2 Rinsate Blanks

Equipment rinsate blanks are the final "analyte free" water rinse from equipment cleaning. Equipment rinsate samples will be associated with sampling that involves reusable equipment, not dedicated or disposable equipment. One rinsate blank will be collected for each type of

equipment used each day a decontamination event is carried out. Rinsate samples will be analyzed for the same parameters as the field samples with which they are associated.

2.4.1.3 Trip Blanks

A trip blank is a sample container filled with organic-free water that is transported unopened from the laboratory to the field with the sample bottles. It is opened in the laboratory and analyzed for VOCs along with the field samples. One trip blank will be submitted with each shipment container transporting VOCs.

2.4.1.4 Field Duplicates

A duplicate is an identical sample collected from the same location, at the same time, under identical conditions as the original. Duplicate samples are analyzed along with the original to ascertain field and laboratory procedural precision, reproducibility, and inherent source variability. Soil and groundwater duplicate samples will be collected to assess the heterogeneity of contaminant concentrations in the each matrix. One field duplicate sample will be collected for every 10 samples per matrix.

2.4.1.5 Matrix Spike/Matrix Spike Duplicates

These investigative samples are treated like QC samples by the laboratory. Soil MS/MSD samples require no extra volume for inorganics. Groundwater MS/MSD samples require three times the volume collected for all parameters. One MS/MSD sample will be collected/designated for every 20 or fewer investigative samples per sample matrix.

2.4.2 Analytical Quality Control Samples

The primary measurements for laboratory QA/QC are derived from method blanks, instrument (system) blanks, laboratory duplicates, internal standards, MS/MSDs, surrogate spikes, LCSs, LFBs, instrument performance check samples, initial calibration, and continuing calibration/calibration verification checks. Evaluation of QA objectives for these samples is described in Section 4.2.2 of this document. Table 2-5 summarizes QC samples that are

frequently incorporated into chemical data collection. The following sections briefly describe the types of QC samples that will be used for the RFI.

Table 2-5
Recommended Types and Frequency of Analytical QC Samples for Chemical Data Collection

Quality Control Sample	Data Quality Indicator	Recommended Frequency
Method Blanks	Accuracy/Bias (Contamination)	Minimum 1 per SDG per analytical group per matrix per concentration level
Instrument (System) Blanks	Accuracy/Bias (Contamination)	As specified by method
Laboratory Duplicates	Precision	Minimum 1 per inorganic SDG per analytical group per matrix per concentration level
Internal Standards	Precision and Accuracy/Bias	As specified by method and based on PQOs
MS/MSD Samples	Accuracy/Bias	Minimum 5% per analytical group per matrix per sampling procedure per sampling team
Surrogate Spikes	Bias	As specified by method and based on PQOs
LCS Samples	Bias	As specified by method and based on PQOs
LFB Samples	Bias and Sensitivity	Minimum 1 per aqueous low concentration organic SDG/analytical group. As specified by method and based on PQOs for other analytical groups, matrices, and concentration levels
Instrument Performance Check Samples	Sensitivity	As specified by method and based on PQOs
Initial Calibration	Accuracy	After initial instrument setup, as specified by method and when calibration verification fails
Continuing Calibration/Calibration Verification Checks	Accuracy	Minimum 1 per analytical shift and more frequently as specified by method and based on PQOs

2.4.2.1 Method Blanks

A method blank is a sample of a matrix similar to the batch of associated samples (when available) in which no target analytes or interferences are present at concentrations that impact the analytical results. It is processed simultaneously with samples of similar matrix and under the same conditions as the samples.

2.4.2.2 Instrument (System) Blanks

An instrument blank is an aliquot of analyte-free water or solvent processed through the instrumental steps of the measurement process to determine the presence of carryover from the previous analysis. Analysis does not include any sample preparation.

2.4.2.3 Laboratory Duplicates

A laboratory duplicate is two or more representative portions taken from one homogeneous sample by the laboratory and analyzed in the same laboratory. Laboratory duplicate samples are quality control samples that are used to assess intralaboratory preparatory and analytical precision.

2.4.2.4 Internal Standards

Internal standards are added to a test portion of a sample in a known amount and carried through the entire determination procedure as a reference for calibrating and controlling the precision and bias of the applied analytical method.

2.4.2.5 Matrix Spike/Matrix Spike Duplicate Samples

MS/MSD samples are prepared by adding a known concentration of a target analyte to an aliquot of a specific homogenized environmental sample for which an independent estimate of the target analyte concentration is available. The matrix spike is accompanied by an independent analysis of the unspiked aliquot of the environmental sample. Spiked samples are used to determine the effect of the matrix on a method's recovery efficiency and precision.

2.4.2.6 Surrogate Spikes

A surrogate is a pure substance with properties that mimic the analyte of interest and is only added to organic analyses. Surrogates are brominated, fluorinated, or isotopically labeled compounds unlikely to be found in environmental samples. These analytes are added to samples to evaluate analytical efficiency by measuring recovery.

2.4.2.7 Laboratory Control Samples

An LCS is a sample of known composition prepared using reagent-free water or an inert solid that is spiked with analytes of interest at the midpoint of the calibration curve or at the level of concern. It is analyzed using the same sample preparation, reagents, and analytical methods employed for regular samples.

2.4.2.8 Laboratory Fortified Blank Samples

An LFB is a low-level LCS sample spiked with analytes of interest at the quantitation limit. It is used to evaluate laboratory preparatory and analytical sensitivity and bias for specific compounds.

2.4.2.9 Instrument Performance Check Samples

An instrument performance check is performed to ensure adequate mass resolution, identification, and to some degree, sensitivity on the gas chromatograph/mass spectrometer (GC/MS). The criteria are not sample-specific. Conformance is determined using standard materials, therefore, these criteria should be met in all circumstances.

2.4.2.10 Initial Calibration

The initial calibration is an analysis of analytical standards at different concentrations that is used to define the linearity and dynamic range of the response of the analytical detector or method.

2.4.2.11 Continuing Calibration/Calibration Verification Checks

The continuing calibration or calibration verification is a check of the initial calibration that is performed during the course of an analytical shift at period intervals using a calibration check standard. Continuing calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and nonlinear calibration models. The purpose is to assess the continued capability of the measurement system to generate accurate and precise data over a period of time.

2.5 DATA MANAGEMENT TASKS

All project data and information must be documented in a format that is usable by project personnel. Therefore, the following sections will describe how project data and information will be documented, tracked, and managed, from generation in the field to final use and storage, in a manner that ensures data integrity, defensibility, and retrieval.

2.5.1 Project Documentation and Records

All project documents and records that will be generated for every aspect of the project are listed below. These include but are not limited to the following:

1. Sample Collection and Field Measurement Records
   - Field data collection sheets;
   - Chain-of-custody records;
   - Air bills;
   - Communication logs;
   - Corrective action reports;
   - Documentation of corrective action results;
   - Documentation of deviation from methods;
   - Documentation of internal QA review;
   - Electronic data deliverables;
   - Identification of QC samples;
   - Meteorological data from field (e.g., wind, temperature);
   - Sampling instrument decontamination records;
   - Sampling instrument calibration logs;
   - Sampling location and sampling plan;
   - Sampling notes and drilling logs; and,
   - Sampling report.

2. Analytical Records
   - Chain-of-custody records;
   - Sample receipt forms and sample tracking forms;
   - Preparation and analysis forms and/or logbooks;
   - Tabulated data summary forms and raw data for field samples, standards, QC checks, and QC samples;
   - Case narrative;
   - Sample chronology (time of receipt, extraction, and analysis);
   - Identification of QC samples;
   - Communication logs;
   - Corrective action reports;
   - Definitions of laboratory qualifiers;
   - Documentation of corrective action results;
   - Documentation of laboratory method deviations;
   - Electronic data deliverables;
   - Instrument calibration reports;
   - Laboratory name;
   - Laboratory sample identification numbers;
   - Reporting forms, completed with actual results;
   - Signatures for laboratory sign-off (e.g., laboratory QA manager);

- Standards traceability records; and,
- Other project-specific documents in the laboratory's possession, such as telephone logs, MDL studies, initial precision and accuracy tests, laboratory preaward documentation (including preaward PT sample data and relevant copies of proposal package), and corrective action reports.

3. Project Data Assessment Records
   - Field sampling audit checklists;
   - Analytical audit checklists;
   - PT sample results;
   - Data review reports;
   - Telephone logs;
   - Corrective action reports;
   - Laboratory assessment;
   - Laboratory QA plan;
   - MDL study information; and,
   - NELAP accreditation.

2.5.2 Data Package Deliverables

Quality criteria are outlined in this section to ensure that the RFI data are suitable for their intended use, and to meet the goals established by the EPA Data Quality Objective (DQO) documents (February 2006). DQOs are qualitative and quantitative statements specifying the quality and quantity of data required for supporting decisions made during closure activities. They are based on the end uses of the data being collected, and as such, different uses may require different levels of data quality.

To meet the project QA objectives, Beckton Environmental Laboratories, Inc. will supply QC information to assess data accuracy and precision. EPA's *Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs*, EPA-505-B-04-900A, March 2005, describes laboratory QC deliverable. All laboratory analytical procedures will be conducted according to *Test Methods for the Evaluation of Solid Wastes*, SW-846, Third Edition - Office of Solid Waste and Emergency Response. Draft Update IVB, November 2000, to extent available for such analytes.

The DQOs relevant to the sampling, analytical, and field measurement techniques used in generating data for the site characterization and pre-design activities will be established in terms of precision, accuracy, comparability, representativeness, and completeness. Sample data will be analyzed and reported as definitive data.

Definitive data are generated using rigorous analytical methods, such as approved EPA reference methods. Data are analyte-specific with confirmation of analyte identity and concentration. The methods produce tangible raw data (e.g. chromatograms, spectra, digital values) in the form of paper printouts or computer generated electronic files. Data may be generated at the site or at an off-site location, as long as the QA/QC requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined.

Ten percent of the analytical data will be selected at random and will be definitive with all raw data included: reported using, but will not be limited to CLP-like forms. Ten percent definitive data with raw data (formerly known as CLP Level IV) has proved in the past to provide enough evidence that the project laboratory is presenting valid, acceptable, and legally defensible data. The remaining 90% of the analytical data will also be definitive, but will not include the raw data (formerly known as CLP Level III). It must contain, but is not limited to sample results, holding times, method blank results, MS/MSD results, LCS results, internal standard results, duplicate results, and surrogate results.

For all data collection events, a laboratory data package will be provided for each set of samples and will have a designated SDG ID. The parameters being measured and analytical methods to be used were presented in Table 2-1 and all samples will be analyzed as definitive data (analytical data that are suitable for final decision-making). Ten percent of the data will be reported at definitive data with raw data. The analytical data packages provided by the laboratory include, but are not limited to the items listed in Table 2-6 and Table 2-7 below.

Table 2-6
Hardcopy Data Deliverables for EPA and PREQB Definitive Data Quality Assurance — Organics

Definitive Data Deliverable Requirements — VOC, SVOC, PEST, & Herbicide Organics	CLP Equivalents
Case Narrative should contain: laboratory name; SDG number; sample identifications in the SDG including differentiations between initial analyses and re-analyses; analyses performed for each sample; and detailed documentation of all quality control, sample shipment and/or analytical problems encountered in processing the samples reported in the data package. The narrative must also include any problems encountered or deviations from the requested analytical method, both technical and administrative, corrective actions taken, and resolution and explanation for all laboratory flags. In addition, the narrative must document all instance of manual integration with a brief explanation of the manual integration. Lastly, the narrative must contain a signed certification statement.	Case Narrative
Sample, method blank, and MS/MSD results must be tabulated or reported on spreadsheet. Results greater than the MDL and less than the quantitation limit will be reported as estimated.	Form I equivalent
Surrogate recoveries for all samples including QA/QC samples, to be used in VOC and SVOC analyses.	Form II equivalent
MS/MSD (one spike and one spike duplicate per 20 samples of similar matrix). Spike sample and spike duplicate results will be tabulated. Percent recoveries and RPD will be tabulated and summarized.	Form III equivalent
Method blank summary analyzed per matrix/concentration.	Form IV equivalent
GC/MS tuning every 12 hours for VOC and SVOC. Ion abundance criteria reported. Samples associated with each 12-hour tuning period must be reported with analysis dates and times.	Form V equivalent
Initial five-point calibration data for VOC and SVOC should include RRFs and %RSD. Separate calibrations are needed for low and medium VOC samples per matrix/concentration.	Form VI equivalent
Continuing calibration GC/MS data with RRFs and %D. Separate calibrations are needed for low and medium samples per matrix/ concentration.	Form VII equivalent
Internal standard areas and retention times are to be reported for every VOC and SVOC sample.	Form VIII equivalent

Notes:
Definitive data deliverables with raw data will include all data indicated above, sample chromatograms, data printouts and mass spectra for all samples including QA/QC (blanks, MS/MSD, samples, calibrations). In addition, a hardcopy printout of the extracted ion current profile (EICP) of the quantitation ion displaying any manual integration shall be included in the raw data.

MDL = Method detection limit
RRF = Relative response factors

Table 2-7
Hardcopy Data Deliverables for EPA and PREQB Definitive Data Quality Assurance — Inorganics

Definitive Data Deliverable Requirements — Metals and other Inorganics	CLP Equivalent
Case Narrative should contain: laboratory name; SDG number; sample identifications in the SDG including differentiations between initial analyses and re-analyses; analyses performed for each sample; and detailed documentation of all quality control, sample shipment and/or analytical problems encountered in processing the samples reported in the data package. The narrative must also include any problems encountered or deviations from the requested analytical method, both technical and administrative, corrective actions taken, and resolution and explanation for all laboratory flags. In addition, the narrative must contain a signed certification statement.	Case narrative
Sample results. Results between the instrument detection limit and the quantitation limit are required to be reported and flagged as estimated.	Form I equivalent
For ICP, an initial 1-point calibration is to be analyzed. For GFAA, an initial 3-point calibration (minimum) is to be analyzed and results are to be reported. After the calibration, the curve must be verified by at least a calibration blank and a calibration check standard at or near mid-range. The calibration must be measured within 10% of its true value to be valid.	Form IIA equivalent
Check or reference standards are to be analyzed and results reported. A check or reference standard should be analyzed after every 10 sample injections. This sample must be within 20% of its true value.	Form IIB equivalent
Initial and continuing calibration blank results. Calibration blanks analyzed at a 10% frequency.	Form III equivalent
Preparation blank results. Preparation blanks are to be taken through digestion (1/20 samples of the same matrix or SDG, whatever is most frequent).	Form III equivalent
ICP interference check sample results. True and found results must be reported.	Form IV equivalent
Spike sample recoveries (1 per 20 samples of a similar matrix).	Form VA equivalent
Post digestion spike results. (Reported when MS/MSD fail).	Form VB equivalent
Serial dilution results.	Form IX equivalent
Laboratory duplicate results and RPDs (1 per 20 samples or analytical batch — whichever is most frequent — will be split and digested as a separate sample).	Form IV equivalent
Laboratory control samples will be processed with each sample batch.	Form VII equivalent
Instrument Detection Limits.	Form X equivalent
Preparation Logs.	Form XIII equivalent
Analysis Run Log.	Form XIV equivalent
Standard addition results (if performed).	Form VIII equivalent
Post-digestion spike recoveries for GFAA.	Noted on Analysis Run Log

Notes:
Definitive data deliverables will include all data indicated above, sample chromatograms, data printouts and mass spectra for all samples including QA/QC (blanks, MS/MSD, samples, calibrations).

SDG = Sample delivery group
IDL = Instrument detection limit
MDL = Method detection limit

If field measurements such as specific conductance, temperature, dissolved oxygen, pH, turbidity, oxidation/reduction potential, and residual chlorine are collected, then those results, applicable instrument calibration, and calibration verifications will be recorded in the field logbook to ensure proper verification of the sample results.

The laboratory descriptions on their data reporting formats, data handling and management, and data tracking and control are included in their LQAP found in Appendix B.

All data results will be reported in Electronic Data Deliverables (EDDs) in addition to the hard copy data packages. These will be included on an Excel spreadsheet and will include, but not be limited to the items in Table 2-6 and Table 2-7.

All chain-of-custody forms received by Beckton Environmental Laboratories, Inc. will be signed and dated by the laboratory sample custodian and returned as part of the data-reporting package. The laboratory will carry the custody process throughout the laboratory as indicated in their LQAP. The laboratory's document control system, storage and retrieval on electronic media, control mechanism for detecting and correcting errors and preventing loss of data during reduction and reporting is also be indicated in their LQAP.

2.5.3 Data Reporting Formats

Procedures for recording data, including guidelines for recording and correcting data can be found in Section 3 of the Region 4 *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual* (EISOPQAM), November 2001. This document can be found in Appendix H of this QAPP.

2.5.4 Data Handling and Management

Laboratory data handling and management procedures can be found in Beckton's LQAP in Appendix B of this QAPP. Data handling and management will also follow the procedures outlined in the following SOPs included in Appendix G:

- Document Control (#SESDPROC-001-R5);
- Control of Records (#SESDPROC-002-R5); and,
- Logbooks (#SESDPROC-010-R4).

The data for this project will be produced in the field and at Beckton Environmental Laboratories. Data collected onsite will be recorded into field logbooks. Copies of the field logbooks will be submitted to the EPA and PREQB with the final RFI Report. The laboratory data will be submitted by Beckton to the Project QAO within 30 days of the laboratory's receipt of the samples; unless a faster turn-around time has been requested. The lab reports will also be submitted to the EPA and PREQB with the final RFI report that NewFields and CORCO will produce upon completion of the RFI.

Microsoft Excel, Microsoft Access© and ArcMap software are utilized by NewFields to process and analyze the data. Data is analyzed by mapping the data laterally and vertically, by producing time series graphs of the data, and through various other means such as statistical calculation or ratio analysis, depending on the investigation requirements.

The field and analytical records submitted to the EPA will be maintained and managed in the administrative record by the project QAO. The physical data will remain in her office or under her control in a locked facility in NewField's Atlanta, Georgia offices. Upon completion and approval of the project by EPA, the project records listed will be moved to an off-site locked facility and will be maintained there for 25 years.

2.5.5 Data Tracking and Control

Document control refers to the maintenance of inspection and investigation project files. All information below shall be kept in project files. Investigators may keep copies of reports in their personal files, however, all official and original documents relating to inspections and investigations shall be placed in the official project files in NewFields Atlanta, Georgia offices.

2.5.5.1 Data Tracking

Data tracking is performed by the use of chains-of-custody. As stated in Section 2.3.3.1.3, "the field chain-of-custody record (Figure 2-3) is used to record the custody of all samples collected and maintained by investigators. All sample sets shall be accompanied by a chain-of-custody record. This chain-of-custody record documents transfer of custody of samples from the sample custodian to another person, to the laboratory, or other organizational elements. To simplify the chain-of-custody record and eliminate potential litigation problems, as few people as possible should have custody of the samples during the investigation. This form shall not be used to document the collection of split samples where there is a legal requirement to provide a receipt for samples. The chain-of-custody record also serves as a sample logging mechanism for the laboratory sample custodian. A separate chain-of-custody record should be used for each final destination of the samples collected during the investigation." Samples and data will not be transferred from the field to the lab to the project QAO without the respective chain-of-custody.

Beckton's procedure for data tracking can be found in Appendix B.

The Project Manager will send to the selected lab a copy of the RFI Work Plan. This will include the QAPP which provides the estimated number of samples, type of analysis required, approximate dates of sample delivery to the laboratory necessary to provide analytical results, including hard copies and electronic deliverables. These documents shall be used by the laboratory in determining project-specific capability and the type of analytical parameters required. They will be provided in advance of the first scheduled sample shipment.

The laboratory shall respond in a timely manner, by sending to CORCO a signed acceptance form via fax. CORCO will notify the laboratory if samples cannot be delivered on or about the date specified.

The laboratory will be responsible for shipping sample bottles and shipping containers to CORCO, and sample shipment from the field to the laboratory will be CORCO's responsibility.

CORCO or NewFields will indicate who is to receive bottles, where they are to be delivered, and when they are to be received.

The laboratory shall not subcontract any of these services (either to another division within the company or an outside company) without the express written consent of CORCO. If consent is given, the laboratory certifies that the sample numbers and identifiers in the SAP and QAPP shall remain unchanged. All internal identification shall remain the same and all other related information shall remain consistent. Any and all subcontract costs will be the responsibility of the laboratory.

Once the laboratory has received the samples, their project manager shall fax a copy of the chain of custody to CORCO. A summary sheet identifying all samples received, the required analyses, and the SDG identification will also be faxed to show that the samples have been received. The laboratory must not alter or truncate any digits of the sample identification without prior permission. The sample identification numbers on the chains of custody are to remain on all deliverables.

At times, samples may be received at the laboratory above the temperature preservation requirement of $4^{o}C$ +/- 2^{o}, or improperly preserved upon collection. If so, the sample temperature or absent chemical preservation shall be documented in the case narrative by the laboratory, who will in turn contact CORCO or NewFields for instruction on how to proceed. The laboratory shall not perform any pH adjustment without notification of and approval by CORCO or NewFields. If any other problems arise during analysis, the laboratory shall contact CORCO or NewFields for resolution.

Final hard copy sample results from the laboratory shall be submitted to CORCO within the appropriate turnaround time specified. The hard copy and electronic data will be submitted to CORCO. An identical hard copy of the data is to be submitted to the designated QAO. Acceptance of the analytical service will not be deemed final until a satisfactory electronic deliverable has been accepted by CORCO.

Upon acceptance, the electronic data will be loaded into CORCO's database and the project QAO will notify personnel that the data is available. As previously stated in Section 2.5.4 "Microsoft Excel, Microsoft Access© and ArcMap software are utilized by NewFields to process and analyze the data." The Access© database allows the data to be tracked from receipt to final validation, and then storage.

If the data evaluation process finds, within 60 calendar days from delivery, that data has been omitted, CORCO will contact the laboratory immediately. The laboratory will then have three working days to supply CORCO with the missing data. If CORCO requests the omitted data after 60 calendar days, then the laboratory shall have seven calendar days to supply the data.

The project QAO will notify all project personnel of the data's usability upon completion of the evaluation.

2.5.5.2 Data Storage, Archiving, and Retrieval

All hard copy data and files are stored in the QAO's office or in a designated area at the NewFields Atlanta offices.

The following documents shall be placed in the project file, if applicable:

- Request memo from the program office;
- Copy of the study plan;
- Original Chain-of-custody records and bound field logbooks;
- Copy of the Receipt for Sample forms;
- Records obtained during the investigation;
- Complete copy of the analytical data and memorandums transmitting analytical data;
- Official correspondence received by or issued by the Branch relating to the investigation including records of telephone calls;
- Photographs and negatives associated with the project;
- Project e-mails and fax transmittals;

- One copy of the final report and transmittal memorandum(s); and,
- Relevant documents related to the original investigation/inspection or follow-up activities related to the investigation/inspection.

Inappropriate personal observations and irrelevant information should not be placed in the official project files. At the conclusion of the project, the project leader shall review the file to ensure that it is complete.

As stated in the previous section, the field and analytical records submitted to the EPA and PREQB will be maintained and managed in the administrative record by the project QAO. The physical data will remain in her office or under her control in a locked facility in NewField's Atlanta, Georgia offices. NewFields personnel other than the project QAO who are responsible for storing, archiving, and retrieving project documents, ultimately, are the office manager and the office librarian. While the project is active, all of the CORCO documents will be stored in the 20th floor file room of the NewFields Atlanta offices. When has been completed, the files will be moved to an on-site storage room on the 2nd floor of the same building occupies by NewFields. When the project has been inactive for at least two years, files may be moved to off-site storage for a period of 25 years, depending on space needs within the on-site storage.

Electronic records are maintained using NewFields proprietary document management software, Intradox. All records, whether they are digital or hard copy, are indexed using a Web-accessible PostgreSQL database by title, author, topic, type, and date. Digital files are uploaded into a NetApp filer (which tracks snapshots over a six-week period and is additionally backed up through Veritas with daily incrementals and weekly full backups) and linked to the indexing records; hard copy files are assigned catalog numbers within the database. Documents are then stored in order of their catalog numbers.

2.5.5.3 Data Security

All physical project documents are kept in a secure location within the NewFields Atlanta offices, and are not permitted to leave the premises except when absolutely necessary. Any

documents that are removed are tracked in NewFields document management system to record which personnel have documents and when they are returned. The on-site storage room is locked and is located in an area monitored by security cameras. Only NewFields' Office Manager has a key to the file storage room.

The NetApp filer on NewFields Intradox system tracks snapshots over a 6 week period and is additionally backed up through Veritas with daily incrementals and weekly full backups. There is no user access to the data area, and no facility for removing or updating files from the backend data store, only for removing enduser visibility. The indexing stored in the PostgreSQL database is dumped and permanently stored on the filer every 24 hours, so it can be trivially rolled back to any given date and the electronic document in question retrieved either from the data store or backups as necessary.

NewFields electronic document management system is protected by from the outside world by both hardware and host based firewall systems. Internal services listen only on loopback devices while unused services are disabled to minimize attack surface. In addition, services are regularly updates with security patches.

3.0 ASSESSMENT/OVERSIGHT

3.1 ASSESSMENTS AND RESPONSE ACTIONS

Assessments may be conducted during the RFI activities to evaluate the performance of the entire measurement and reporting system. Parameters included in the system are experimental design, sampling (or data collection), analysis, and attendant QC activities.

All assessments will conducted in accordance with the SESD Internal Audits (#SESDPROC-008-R2) SOP included in Appendix G.

An audit checklist can be found in the EISOPQAM in Appendix H. This checklist will be used as guidance during each of the planned assessments.

3.1.1 Planned Assessments

The following sections list the different assessments that will be performed throughout the duration of the RFI. The

3.1.1.1 Field Systems Assessment

The QAO and/or project manager may routinely evaluate the performance of field personnel and general field operations. They will observe the personnel performance during each type of activity such as water-level readings and sampling rounds and at least monthly. The CORCO project manager or project QAO will be onsite throughout the duration of field activities, and will continually assess the proficiency of each field sampling team member to ensure compliance with QAPP protocols. Field activities may be stopped if the performance of the personnel does not comply with QAPP protocols. Field activities will resume once all deficiencies have been corrected.

3.1.1.2 Laboratory Systems Assessment

Beckton Environmental Laboratories, Inc. must successfully complete an evaluation process, which can include an onsite systems assessment by CORCO or NewFields. NewFields routinely performs systems assessments of laboratories to ensure that systems and operational capability are maintained. They also verify that QC measures are being followed as specified in the analytical methods, laboratory written SOPs, and laboratory LQAP. Assessment results are filed with CORCO and Region 2. If deemed necessary, this assessment will take place just prior to the initiation of sample collection.

Laboratory-initiated assessments are described in the LQAP, kept on file in the CORCO library and at Region 2.

3.1.1.3 Performance Evaluation Assessment

A PE assessment is performed to evaluate a laboratory's ability to obtain accurate and precise results by a specific analytical method for samples containing known analyte concentrations. These PE assessments may include submission of blind spiked check or PE samples for analysis of the parameters in question. Blind PE samples are submitted to the laboratory as field samples to ensure that they are treated the same. PE samples may also be submitted as obvious (known) check samples, which are EPA or National Bureau of Standards traceable. An assessment may be conducted if QA data in the laboratory deliverables are routinely outside acceptable control limits.

If the most recent PE assessment performed by Beckton is deemed unacceptable by the EPA, and additional assessment will be performed just prior to initiation of sample collection.

3.1.1.4 Regulatory Assessment

It is understood that CORCO personnel and subcontract laboratories are also subject to QA assessments by EPA, PREQB, or other state environmental regulatory agencies. In the event of a regulatory assessment, CORCO will incorporate those assessments into any QA/QC evaluation, and may consider action based solely on those results.

3.1.1.5 Project Status Reports

Monthly status reports sent to the EPA and PREQB will indicate what activities took place on site, how much work has been performed, any problems that have been encountered, and what remedies were performed to resolve the problems.

3.1.2 Assessment Findings and Corrective Action Responses

During any investigation, field personnel are responsible for seeing that field instruments are functioning properly and that work progresses satisfactorily. Field personnel are also responsible for performing routine preventive maintenance and QC procedures, thereby ensuring collection of valid field data.

If a problem is detected by field personnel, the project manager shall be notified immediately, at which time corrective action will begin. Similarly, if a problem is identified during a routine audit by the project or regulatory QAO, an immediate investigation will be undertaken and whatever corrective action deemed necessary will be taken as early as possible. Samples or analyses that do not meet QC or QA criteria may be resampled, reanalyzed, or the analysis reviewed by CORCO or its designee. The project manager is responsible for initiating investigation rework and review efforts. The project manager or the QAO will document cases of noncompliance with criteria, report such cases to the project manager, and assure that the corrective action is implemented and recorded. An example of the field Corrective Action Form can be found in Figure 3-1 and the laboratory Corrective Action Form in Figure 3-2.

If corrective action is required by the analytical laboratory, the action should be conducted in accordance with the laboratory QA program and the corrective action process in the laboratory's QAP, following guidelines provided in the analytical methods.

The necessity for corrective action is determined after the data have been evaluated as described in Section 4.2. If data completeness and representativeness have met project objectives, no corrective action will be taken. For data considered grossly deficient compared to project

objectives, corrective action may include but is not limited to reevaluation for limited exclusion or resampling.

Laboratory performance will conform to the requirements of the Statement of Work subcontract between CORCO and Beckton. Unsatisfactory performance by CORCO contracted laboratories will be resolved through measures presented in the terms and conditions of the subcontract.

If any of the planned assessments deemed necessary are found unsatisfactory, corrective action will be implemented following the SESD SOP Corrective Action (#SESDPROC-009-R3) in Appendix G.

The project manager and QAO will be notified as quickly as possible so that corrective action can be implemented immediately and EPA and PREQB will be notified within 48 business hours.

3.2 QA MANAGEMENT REPORTS

As previously stated, monthly status reports sent to the EPA will indicate what activities took place on site, how much work has been performed, any problems that have been encountered, and what remedies were performed to resolve the problems.

These reports will also include the following:

- Summary of project QA/QC programs and trainings conducted during the previous month;
- Conformance of project activities to QAPP requirements and procedures;
- Status of project and schedule delays;
- Deviations from the approved QAPP and approved amendments to the QAPP;
- Results and trends of PE samples performed by all laboratories (per analytical group, matrix, and concentration level);
- Description and findings of audits and other assessments;
- Results of data review activities in terms of amount of usable data generated;
- Required corrective actions and effectiveness of corrective action implementation;
- Data usability assessments in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity; and,

- Limitations on the use of measurement data generated.

3.3 FINAL PROJECT REPORT

In addition to the items described in Section 3.2, the final project report will also include:

- Narrative and timeline of project activities;
- Summary of PQO development;
- Reconciliation of project data with PQOs;
- Summary of major problems encountered and their resolution;
- Data summary, including tables, charts, and graphs with appropriate sample identification or station location numbers, concentration units, percent solids (if applicable), and data quality flags; and,
- Conclusions and recommendations.

The final project report will be submitted 90 days after the data collection report has been completed.

4.0 DATA REVIEW

Data review is the process which data are examined and evaluated to varying levels of detail and specificity by a variety of personnel who have different responsibilities within the data management process. It includes verification, validation, and usability assessment. This section encompasses the data review activities used to ensure that only scientifically sound data that are of known and documented quality and meet PQOs are used in making environmental decisions at the CORCO Site.

4.1 OVERVIEW

Laboratory procedures for data reduction and reporting are included in the LQAP kept in the CORCO library, EPA Region 2 office, and found in Appendix B. Data reduction and reporting by the laboratory will meet CORCO's data evaluation criteria. Data evaluation, the systematic and independent verification of data quality, is performed to verify that the QC requirements of the data set have been met.

For the RFI, analytical reporting requirements will be those specified by the analytical method employed. Data deliverables will be reported by the laboratory as defined in Section 2.5.2 and Tables 2-6 and 2-7. For definitive data and definitive data with raw data, all data quality summary forms will be reported and evaluated.

In order to perform the data verification, data validation, and usability assessment, reported analytical data must be supported by complete data packages, as defined in this QAPP (see Section 2.5.2). Data packages must include sample receipt and tracking information, chain-of-custody records, and tabulated data summary forms. Ninety percent of the data provided by Beckton will be definitive data while the remaining 10% will be definitive data with raw data. One hundred percent of the analytical data will include results for all field samples, standards, QC samples, and all other project-specific documents that are generated. As previously stated, ten percent definitive data with raw data has proved in the past to provide enough evidence that the project laboratory is presenting valid, acceptable, and legally defensible data.

Table 4-1 provides a list of inputs used in the data review process.

Table 4-1
Example Inputs to the Data Review Process

	Item	Step I Verification	Step IIa Compliance	Step IIb Comparison	Step III Usability
Planning Documents					
1	Evidence of required approval of plan (QAPP)	**X**			Uses outputs from previous steps
2	Identification of personnel (those involved in the project and those conducting verification steps)	**X**			
3	Laboratory name	**X**			
4	Methods (sampling and analysis)	**X**	**X**		
5	Performance requirements (including QC criteria) for all inputs	**X**	**X**	**X**	
6	Project quality objectives	**X**		**X**	
7	Reporting forms	**X**	**X**		
8	Sampling plans, location, maps, grids, and sample ID Numbers	**X**	**X**		
9	Site identification	**X**			
10	SOPs (sampling and analytical)	**X**	**X**		
11	Staff training and certification	**X**			
12	List of project-specific analytes	**X**	**X**		
Analytical Data					
13	Case narrative	**X**	**X**	**X**	Uses outputs from previous steps
14	Internal laboratory chain of custody	**X**	**X**		
15	Sample condition upon receipt, and storage records	**X**	**X**		
16	Sample chronology (time of receipt, extraction, and analysis)	**X**	**X**		
17	Identification of QC samples (sampling or lab, temporal, and spatial)	**X**	**X**		
18	Associated (batch or periodic) PT sample results	**X**	**X**	**X**	
19	Communication logs	**X**	**X**		
20	Copies of laboratory notebook, records, prep sheets	**X**	**X**		
21	Corrective action reports	**X**	**X**		
22	Definitions of laboratory qualifiers	**X**	**X**	**X**	
23	Documentation of corrective action results	**X**	**X**	**X**	
24	Documentation of individual QC results (e.g., spike, duplicate, LCS)	**X**	**X**	**X**	
25	Documentation of laboratory method deviations	**X**	**X**	**X**	
26	Electronic data deliverables	**X**	**X**		
27	Instrument calibration reports	**X**	**X**	**X**	
28	Laboratory name	**X**	**X**		
29	Laboratory sample identification numbers	**X**	**X**		
30	QC sample raw data	**X**	**X**	**X**	
31	QC summary report	**X**	**X**	**X**	
32	Raw data	**X**	**X**	**X**	
33	Reporting forms, completed with actual results	**X**	**X**	**X**	
34	Signatures for laboratory sign-off (e.g., laboratory QA manager)	**X**	**X**		
35	Standards traceability records (to trace standard source from NIST, for example)	**X**	**X**	**X**	

	Item	Step I Verification	Step IIa Compliance	Step IIb Comparison	Step III Usability
Sampling Documents					
36	Chain of custody	**X**	**X**		
37	Communication logs	**X**	**X**		
38	Corrective action reports	**X**	**X**	**X**	
39	Documentation of corrective action results	**X**	**X**	**X**	
40	Documentation of deviation from methods	**X**	**X**	**X**	
41	Documentation of internal QA review	**X**	**X**	**X**	
42	Electronic data deliverables	**X**	**X**		
43	Identification of QC samples	**X**	**X**	**X**	
44	Meteorological data from field (e.g., wind, temperature)	**X**	**X**	**X**	
45	Sampling instrument decontamination records	**X**	**X**		
46	Sampling instrument calibration logs	**X**	**X**		
47	Sampling location and plan	**X**	**X**	**X**	
48	Sampling notes and drilling logs	**X**	**X**	**X**	
49	Sampling report (from field team leader to project manager describing sampling activities)	**X**	**X**	**X**	
External Reports					
50	External audit report	**X**	**X**	**X**	
51	External PT sample results	**X**	**X**		
52	Laboratory assessment	**X**	**X**		
53	Laboratory QA plan	**X**	**X**		
54	MDL study information	**X**	**X**	**X**	
55	NELAP accreditation	**X**	**X**		

4.2 DATA REVIEW STEPS

4.2.1 Step I: Verification

Verification is a completeness check that is performed before the data review process continues in order to determine whether the required information (the complete data package) is available for further review. It involves a review of all data inputs to ensure that they are present. The question answered by this step is: Are the inputs present? (yes or no). Table 4-1 provides examples of the inputs for conducting the completeness check. Although this step is not designed for use in qualitative review (e.g., a compliance check that takes place during step IIa of the validation process), it is essential for ensuring the availability of sufficient information for subsequent steps of the data review process.

A full review of the data inputs listed in Table 4-1 in the *Step I Verification* column will be performed to ensure that the components of the data package are present.

4.2.2 Step II: Validation

Project-specific validation procedures are developed to identify and qualify data that do not meet the measurement performance criteria of the project. Validation checklists that will be employed by the project QAO can be found in Appendix I. The following EPA guidelines will also be employed as necessary for guidance during the validation process:

- "EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review," OSWER 9240.1-48, USEPA-540-R-08-01, June 2008;
- "EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review," OSWER 9240.1-51, USEPA-540-R-10-011, January 2010; and,
- "Hazardous Waste Remedial Actions Program (HAZWRAP) Requirements for Quality Control of Analytical Data," HAZWRAP Support Contractor Office DOE/HWP-65/R1, July 1990.

4.2.2.1 Step IIa: Validation Activities

Step IIa of the validation process is comparing the sampling and analytical data to compliance with the methods, procedures, and contracts for the project. Data validation will be performed, where applicable, according to the EPA Region 2 SOPs for Data Review (March, 2001), EPA National Functional Guidelines, and EPA precision and accuracy statements for the analytical methods employed. Data evaluation is accomplished through a series of checks and reviews intended to assure that the reported results are of verifiable and acceptable quality.

Table 4-2 lists specific activities that may occur during Step IIa of the validation process.

Table 4-2
Step IIa Validation Activities

	Activity
Data Deliverables and QAPP	Ensure that all required information on sampling and analysis from step I was provided (including planning documents).

	Activity
Analytes	Ensure that required lists of analytes were reported as specified in governing documents (i.e., method, procedure, or contract).
Chain-of-Custody	Examine the traceability of the data from time of sample collection until reporting of data. Examine chain-of-custody records against contract, method, or procedural requirements. Chains-of-custody will also be used to determine if the test method-specific holding time was met.
Holding Times	Identify holding time criteria, and either confirm that they were met or document any deviations. Ensure that samples were analyzed within holding times specified in method, procedure, or contract requirements. If holding times were not met, confirm that deviations were documented, that appropriate notifications were made (consistent with procedural requirements), and that approval to proceed was received prior to analysis.
Sample Handling	Ensure that required sample handling, receipt, and storage procedures were followed, and that any deviations were documented.
Sampling Methods and Procedures	Establish that required sampling methods were used and that any deviations were noted. Ensure that the sampling procedures and field measurements met performance criteria and that any deviations were documented.
Field Transcription	Authenticate transcription accuracy of sampling data (i.e., from field notebook to reports).
Analytical Methods and Procedures	Establish that required analytical methods (off-site laboratory and on-site analytical) were used and that any deviations were noted. Ensure that the QC samples met performance criteria and that any deviations were documented.
Data Qualifiers	Determine that the laboratory data qualifiers were defined and applied as specified in methods, procedures, or contracts.
Laboratory Transcription	Authenticate accuracy of the transcription of analytical data (i.e., laboratory notebook to reporting form, or instrument to LIMS).
Proficiency Testing	Confirm acceptance of PT sample results against performance requirements as specified in methods, procedures, or contracts.
Standards	Determine that standards are traceable and meet contract, method, or procedural requirements.
Communication	Establish that required communication procedures were followed by field or laboratory personnel.
Audits	Review field and laboratory audit reports and accreditation and certification records for the laboratory's performance on specific methods.
Step IIa Validation Report	Summarize deviations from methods, procedures, or contracts. Include qualified data and explanation of all data qualifiers.

In addition, a full review of the data inputs listed in Table 4-1 in the *Step IIa Compliance* column will be performed to ensure that the components of the data package are usable.

Field Data Package

The field data package, including all field records and measurements, will be reviewed for completeness and accuracy by:

- Reviewing field entries on solids and sludge sampling logs for completeness.
- Verifying that rinsate blanks, field blanks, and trip blanks were properly prepared, identified, and analyzed.
- Checking field analyses for equipment calibration and condition.
- Reviewing chain-of-custody forms for proper completion, dates, and signatures of field personnel and the laboratory sample custodian.

Analytical Data Package

The project QAO neither collected the physical samples nor analyzed them; therefore, the analytical data package will be evaluated by the project QAO or designee. The analytical data package evaluation procedure includes, but is not limited to:

- Comparison of sampling, sample extraction, and analysis dates to check that samples were extracted and/or analyzed within the proper holding times;
- Review of analytical methods and required detection limits to verify that they agree with the project data quality objectives;
- Evaluation of all blanks (rinsate, field, trip, reagent, method, and extraction blanks) to assess potential cross-contamination;
- Evaluation of surrogate spike, MS/MSD, LCS/LCSD recoveries, plus internal standard areas to assess accuracy;
- Evaluation of any applicable post digestion spikes and serial dilutions to assess accuracy;
- Evaluation of duplicates (field, MS/MSDs and LCS/LCSDs) to assess precision;
- Review of instrument performance checks (calibration, check samples, tuning) to ensure samples were analyzed within method guidelines;
- Review of all manual integrations, where applicable. For any data that require manual integration, chromatograms will be submitted showing the affected peak before and after the manual integration, as well as the reason for the manual integration;

- Review of any second column confirmations, where applicable; and,
- Assessment of data usability.

4.2.2.2 Step IIb: Validation Activities

Step IIb of the validation process is comparing the sampling and analytical data to the measurement performance criteria. Table 4-3 lists specific activities that may occur during Step IIb of the validation process.

Table 4-3
Step IIb Validation Activities

	Activity
Data Deliverables and QAPP	Ensure that the data report from step IIa was provided.
Deviations	Determine the impacts of any deviations from sampling or analytical methods and SOPs. For example, confirm that the methods given in the QAPP were used and, if they were not, determine if data still meet MPCs. Consider the effectiveness and appropriateness of any corrective action.
Sampling Plan	Determine whether the sampling plan was executed as specified (i.e., the number, location, and type of field samples were collected and analyzed as specified in the QAPP).
Sampling Procedures	Evaluate whether sampling procedures were followed with respect to equipment and proper sampling support (e.g., techniques, equipment, decontamination, volume, temperature, preservatives, etc.).
Co-located Field Duplicates	Compare results of collocated field duplicates with criteria established in the QAPP.
Project Quantitation Limits	Determine that quantitation limits were achieved, as outlined in the QAPP and that the laboratory successfully analyzed a standard at the QL.
Confirmatory Analyses	Evaluate agreement of laboratory results.
Performance Criteria	Evaluate QC data against project-specific performance criteria in the QAPP (i.e., evaluate quality parameters beyond those outlined in the methods).
Data Qualifiers	Determine that the data qualifiers applied in step IIa were those specified in the QAPP and that any deviations from specifications were justified.
Step IIb Validation Report	Summarize outcome of comparison of data to MPC in the QAPP. Include qualified data and explanation of all data qualifiers.

In addition, a full review of the data inputs listed in Table 4-1 in the *Step IIb Comparison* column will be performed to ensure that the components of the data package are usable.

Field Data Package

As in Step IIa, the field data package, including all field records and measurements, will be reviewed for completeness and accuracy by:

- Reviewing field entries on solids and sludge sampling logs for completeness.
- Verifying that rinsate blanks, field blanks, and trip blanks were properly prepared, identified, and analyzed.
- Checking field analyses for equipment calibration and condition.
- Reviewing chain-of-custody forms for proper completion, dates, and signatures of field personnel and the laboratory sample custodian.

Analytical Data Package

The project QAO neither collected the physical samples nor analyzed them; therefore, the analytical data package will be evaluated by the project QAO or designee. As in Step IIa, the analytical data package evaluation procedure includes, but is not limited to:

- Comparison of sampling, sample extraction, and analysis dates to check that samples were extracted and/or analyzed within the proper holding times;
- Review of analytical methods and required detection limits to verify that they agree with the project data quality objectives;
- Evaluation of all blanks (rinsate, field, trip, reagent, method, and extraction blanks) to assess potential cross-contamination;
- Evaluation of surrogate spike, MS/MSD, LCS/LCSD recoveries, plus internal standard areas to assess accuracy;
- Evaluation of any applicable post digestion spikes and serial dilutions to assess accuracy;
- Evaluation of duplicates (field, MS/MSDs and LCS/LCSDs) to assess precision;
- Review of instrument performance checks (calibration, check samples, tuning) to ensure samples were analyzed within method guidelines;
- Review of all manual integrations, where applicable. For any data that require manual integration, chromatograms will be submitted showing the affected peak before and after the manual integration, as well as the reason for the manual integration;

- Review of any second column confirmations, where applicable; and,
- Assessment of data usability.

4.2.3 Step III: Usability Assessment

Step III of the validation process considers whether data meet project DQOs as they relate to the decision to be made, and evaluates whether data are suitable for making that decision.

The data will be evaluated to assess whether they meet project quality objectives as they relate to the RFI. The data will be certified by the project QA officer or designee based on the level of reportables and the result of evaluating field and analytical data packages. These include, but are not limited to precision, accuracy/bias, representativeness, comparability, sensitivity, quantitation limits, and completeness as described in Section 1.6.2.

The possible data qualification flags are:

Validation Qualifiers

U **Undetected** — The analyte was present in a sample, but at a concentration less than 10 times the blank concentration for common organic constituents (methylene chloride, acetone, 2-butanone and phthalate esters), or five times the blank concentration for other constituents; the associated value shown is the quantitation limit after evaluation of the blank.

J **Estimated Value** — At least one QC parameter was outside control limits.

UJ **Undetected and Estimated** — The target analyte was analyzed for, but not detected above the listed estimated quantitation limit; the quantitation limit is estimated because one or more QC parameters were outside control limits.

D **Diluted Result** — The result was obtained from a diluted sample.

R/UR **Unusable Data** — At least one QC parameter grossly exceeded control limits.

These flags are applied to data where deficiencies are noted during validation. Because the laboratory uses some of the same qualifiers during analyses, laboratory qualifiers "U" and "J"

will remain on the data, unless superseded by a validation qualifier (e.g., "UJ" or "UR"). Laboratory qualifiers that remain on the data after validation are described below:

Laboratory Qualifiers

U **Undetected** — The target analyte was not detected above the PQL.

J **Estimated Value Below PQL** — The analyte was detected below the PQL and is estimated.

4.2.3.1 Data Limitations and Actions from Usability Assessment

Precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity are important components of validation and usability assessment.

4.2.3.1.1 Precision

Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance, percent difference, or range, in either absolute or relative terms. Examples of QC measures for precision include field duplicates, laboratory duplicates, matrix spike duplicates, analytical replicates, and surrogates.

Table 4-4 lists the requirements for precision.

Table 4-4
Precision Requirements

Analyses	Matrix	Analyte	QC Parameter	%RPD
VOA, SVOC, PCB, Metals, EPH/VPH, TPH	Solid	All	Field Duplicate	< 35%, or CRQL depending on sample conc. (Met only)
VOA, SVOC, Metals, EPH/VPH, TPH	Aqueous	All	Field Duplicate	<20%, or CRQL depending on sample conc. (Met only)
Metals	Solid	All	Lab Duplicates	< 35%, or CRQL depending on sample conc. (Met only)
Metals	Aqueous	All	Lab Duplicates	<20%, or CRQL depending on sample conc. (Met only)
VOA	Solid	1,1-Dichloroethene	MS/MSD	< 22%

Analyses	Matrix	Analyte	QC Parameter	%RPD
		Benzene	Replicates	< 21%
		Trichloroethene		< 24%
		Toluene		< 21%
		Chlorobenzene		< 21%
VOA	Aqueous	1,1-Dichloroethene	MS/MSD Replicates	< 14%
		Benzene		< 11%
		Trichloroethene		< 14%
VOA	Aqueous	Toluene	MS/MSD Replicates	< 13%
		Chlorobenzene		< 13%
SVOC	Solid	Phenol	MS/MSD Replicates	< 35%
		2-Chlorophenol		< 50%
		N-nitroso-di-n-propylamine		< 38%
		4-Chloro-3-methylphenol		< 33%
		Acenaphthalene		< 19%
		4-Nitrophenol		< 50%
		2-4-Dinitrotoluene		< 47%
		Pentachlorophenol		< 47%
		Pyrene		< 36%
SVOC	Aqueous	Phenol	MS/MSD Replicates	< 35%
		2-Chlorophenol		< 50%
		N-nitroso-di-n-propylamine		< 38%
		4-Chloro-3-methylphenol		< 33%
		Acenaphthalene		< 19%
		4-Nitrophenol		< 50%
		2-4-Dinitrotoluene		< 47%
		Pentachlorophenol		< 47%
		Pyrene		< 36%
Metals	Soil	All	Serial Dilution	< 15% Difference where original concentration > 50 x MDL
Metals	Aqueous	All	Serial Dilution	< 10% Difference where original concentration > 50 x MDL
EPH	Aqueous	EPH	MS/MSD Replicates	< 25%
EPH	Solid	EPH	MS/MSD Replicates	< 25%
VPH	Aqueous	VPH	MS/MSD Replicates	< 25%
VPH	Solid	VPH	MS/MSD Replicates	< 25%
EPH	Aqueous	EPH	LCS/LCSD	< 25%
EPH	Solid	EPH	LCS/LCSD	< 25%
VPH	Aqueous	VPH	LCS/LCSD	< 25%
VPH	Solid	VPH	LCS/LCSD	< 25%
TPH	Aqueous	TPH	MS/MSD Replicates	< 20%
TPH	Solid	TPH	MS/MSD Replicates	< 20%

If the data validation indicates that analytical imprecision exists for a particular data set or SDG, then the impact of that imprecision on usability will be discussed in the usability report.

4.2.3.1.2 Accuracy/Bias

Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) that are due to sampling and analytical operations. Examples of QC measures for accuracy include PE samples, MS/MSDs, LCSs, and equipment blanks.

Table 4-5 lists the requirements for accuracy.

Table 4-5
Accuracy Requirements

Analyses	Analyte	QC Parameter	Groundwater %R	Soil %R
VOA	1,4-Difluorobenzene	Surrogate	75 – 126	83 – 121
	4-Bromofluorobenzene		68 - 137	58 - 146
VOA	1,1-Dichloroethene	MS/MSD	61 – 145	59 – 1725
	Benzene		76 – 127	66 – 142
	Trichloroethene		71 – 120	62 – 137
	Toluene		76 – 125	59 – 139
	Chlorobenzene		75 – 130	60 – 133
SVOC	2-Fluorophenol	Surrogates	20 – 136	23 – 138
	Phenol-d5		45 – 125	34 – 139
	Nitrobenzene-d5		43 – 122	27 – 143
	2-Fluorobiphenyl		45 – 131	23 – 170
	2,4,6-Tribromophenol		35 – 123	20 – 140
	Terphenyl-d14		50 – 123	47 – 147
SVOC	Phenol	MS/MSD	12 – 110	26 – 90
	2-Chlorophenol		27 – 123	25 – 102
	N-nitroso-di-n-propylamine		41 - 116	41 – 126
	4-Chloro-3-methylphenol		23 – 97	26 – 103
	Acenaphthalene		46 – 118	31 – 137
	4-Nitrophenol		10 – 80	11 – 114
	2-4-Dinitrotoluene		24 – 96	28 – 89
	Pentachlorophenol		9 – 103	17 - 109
	Pyrene		26 - 127	35 - 142
PCB	Decachlorobiphenyl	Surrogates	14 - 161	14 - 161
Metals	All	Interference Check Sample	+ CRQL or + 20% of true value	+ CRQL or + 20% of true value

Analyses	Analyte	QC Parameter	Groundwater %R	Soil %R
			(whichever is greater)	(whichever is greater)
Metals	All	MS	75 – 125	75 – 125
Metals	All	Post Digestion Spike analyzed if MS/MSD fails	80 – 120	80 – 120
Metals	All	LCS	70 – 130 50 – 150 (Sb & Ag)	70 – 130 50 – 150 (Sb & Ag)
EPH	EPH	Surrogates	40 - 140	40 - 140
VPH	VPH	Surrogates	70 - 130	70 - 130
EPH	EPH	LCS	40 - 140	40 - 140
VPH	VPH	LCS	70 – 130	70 - 130
TPH	TPH	LCS	70 – 130	70 - 130
EPH	EPH	MS/MSD	40 - 140	40 - 140
VPH	VPH	MS/MSD	70 – 130	70 - 130
TPH	TPH	MS/MSD	70 – 130	70 - 130

4.2.3.1.3 Representativeness

Representativeness is the measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition. In order to meet the needs of the data users, project data must meet the measurement performance criteria for sample representativeness specified in Section 1.6.2.4.

4.2.3.1.4 Comparability

Comparability is the degree to which different methods, data sets, and decisions agree or can be represented as similar. Comparability describes the confidence (expressed qualitatively or quantitatively) that two data sets can contribute to a common analysis and interpolation. In order to meet the needs of the data users, project data must meet the measurement performance criteria for comparability specified in Section 1.6.2.5.

If two or more sampling procedures or sampling teams will be used to collect samples, comparability will be assessed for each matrix, analytical group, and concentration level by reviewing the field logbooks to ensure all teams followed the SOPs.

If split samples are analyzed, the same methods must be utilized for analysis. The RPD of each split pair will be calculated and the results of each sample will be compared to each other for precision.

Screening data will be confirmed by analysis by the off-site laboratory, Beckton. The results will be compared to each other and the RPD will be calculated for each pair of data.

4.2.3.1.5 Sensitivity and Quantitation Limits

Sensitivity is the capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. Examples of QC measures for determining sensitivity include laboratory fortified blanks, a method detection limit study, and calibration standards at the QL.

Detection limits are described in many different terms depending on the analysis being performed and the capabilities of the instrument. The following terms are important in describing detection limits:

- Method Detection Limit (MDL) is defined as the lowest concentration of an organic analyte a method can reliably detect taking into consideration the reagents and preparation steps applied to a sample.
- Practical Quantitation Limit (PQL) is the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operations. The PQL is generally five to ten times the MDL.
- Instrument Detection Limit (IDL) is the smallest signal above background noise that can be reproduced, achieving statistical confidence requirements for varying inorganic analytical runs and conditions. For this investigation, the IDLs will be lower than the background levels.

4.2.3.1.6 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct, normal circumstances.

Completeness will be calculated using the formula presented in Section 1.6.2.6. Completeness will be calculated overall for each of individual nine AOCs. It should be noted that while the completeness objective is normally 95, a lower completeness objective might be acceptable in situations where the samples are highly contaminated or where the sample matrices present severe analytical interference problems. If a particular AOC proves to be highly contaminated (i.e. 90 of the sample results exceed the action levels), the completeness goal will be 90. If the AOC is not highly contaminated, the completeness goal will be 95.

A measurement will be determined to be valid if it is not rejected (assigned an "R" qualifier). The total number of results per matrix per AOC will be divided into this number to calculate the percent completeness.

4.2.3.2 Activities

Upon completion of the data validation steps, the project manager and QAO will assess the usability of the data. Table 4-6 lists the considerations that will be used for determining data usability.

Table 4-6
Considerations for Usability Assessment

Item	Assessment Activity
Data Deliverables and QAPP	Ensure that all necessary information was provided, including but not limited to validation results.
Deviations	Determine the impact of deviations on the usability of data.
Sampling Locations, Deviation	Determine if alterations to sample locations continue to satisfy the project objectives.
Chain-of-Custody, Deviation	Establish that any problems with documentation or custody procedures do not prevent the data from being used for the intended purpose.

Item	Assessment Activity
Holding Times, Deviation	Determine the acceptability of data where holding times were exceeded.
Damaged Samples, Deviation	Determine whether the data from damaged samples are usable. If the data cannot be used, determine whether resampling is necessary.
PT Sample Results, Deviation	Determine the implications of any unacceptable analytes (as identified by the PT sample results) on the usability of the analytical results. Describe any limitations on the data.
SOPs and Methods, Deviation	Evaluate the impact of deviations from SOPs and specified methods on data quality.
QC Samples	Evaluate the implications of unacceptable QC sample results on the data usability for the associated samples. For example, consider the effects of observed blank contamination.
Matrix	Evaluate matrix effects (interference or bias).
Meteorological Data and Site Conditions	Evaluate the possible effects of meteorological (e.g., wind, rain, temperature) and site conditions on sample results. Review field reports to identify whether any unusual conditions were present and how the sampling plan was executed.
Comparability	Ensure that results from different data collection activities achieve an acceptable level of agreement.
Completeness	Evaluate the impact of missing information. Ensure that enough information was obtained for the data to be usable (completeness as defined in PQOs documented in the QAPP).
Background	Determine if background levels have been adequately established (if appropriate).
Critical Samples	Establish that critical samples and critical target analytes/COCs, as defined in the QAPP, were collected and analyzed. Determine if the results meet criteria specified in the QAPP.
Data Restrictions	Describe the exact process for handling data that do not meet PQOs (i.e., when measurement performance criteria are not met). Depending on how those data will be used, specify the restrictions on use of those data for environmental decision-making.
Usability Decision	Determine if the data can be used to make a specific decision considering the implications of all deviations and corrective actions.
Usability Report	Discuss and compare overall precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity for each matrix, analytical group, and concentration level. Describe limitations on the use of project data if criteria for data quality indicators are not met.

4.3 STREAMLINING DATA REVIEW

Streamlining data review refers to a process of eliminating some requirements for validation (Steps IIa and IIb) that are deemed no longer necessary to preserve data integrity. Streamlining data review is meant to reduce time and costs while still confirming the quality of the data.

For the CORCO RFI, 100% of the data will be verified; however, ten percent of the analytical data will be presented and validated as definitive data with raw data (formerly known as CLP Level IV), chosen on a random basis. Based on past experience, it has been proven to provide enough evidence that the project laboratory is presenting valid, acceptable, and legally defensible data. The remaining 90 of the analytical data will also be definitive, but will not include the raw data (formerly known as CLP Level III).

If mistakes are identified in any of the validated SDGs, the QAO can use her professional judgment to require the laboratory to provide more than 10 definitive data with raw data and to validate a greater percentage of the definitive data.

5.0 REFERENCES

EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*, Office of Solid Waste and Emergency Response, 9240.1-51, USEPA-540-R-10-011, January 2010.

EPA, *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*, Office of Solid Waste and Emergency Response, 9240.1-48, USEPA-540-R-08-01, June 2008.

EPA, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, Region 4, November 2001.

EPA, *Field Branches Quality System and Technical Procedures*, Region IV, Science and Ecosystem Support Division. Athens, Georgia. May 2009.

EPA, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001, February 2006.

EPA, Region II CERCLA Quality Assurance Manual*, Final Copy, Revision 1, October 1989.*

EPA, *Risk Assessment Guidance for Superfund* (RAGS), Volume I, Human Health Evaluation Manual, Part A, EPA/540/1-89/002, December 1989.

EPA, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Office of Solid Waste and Emergency Response, OSWER 9355.4-24, December 2002.

EPA, *Test Methods for the Evaluation of Solid Wastes, SW-846,* Third Edition. Office of Solid Waste and Emergency Response. Update IVB, November 2000.

EPA, *Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs, Part 1: UFP-QAPP Manual*, EPA-505-B-04-900A, Final Version 1, March 2005.

United States Department of Energy, *Hazardous Waste Remedial Actions Program (HAZWRAP) Requirements for Quality Control of Analytical Data*, HAZWRAP Support Contractor Office DOE/HWP-65/R1, July 1990.